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ABSTRACT

A study examined the feasibility of performing a national cost-benefit analysis of secondary, postsecondary, and adult vocational education. The study involved three components: a survey of the state of the art of utilizing cost-benefit methodologies to evaluate the returns on investments in vocational education; an overview of the potential measurement problems in performing a national study and strategies to overcome or minimize these problems; and a Delphi analysis soliciting input from technical experts (including economists, vocational educators, mathematicians, and Department of Education staff) on the desirability and feasibility of various components of a proposed cost-benefit model of vocational education. While data from these three sources suggest that a national cost-benefit study of vocational education is technically feasible, there are numerous limitations in specifying the relationship between vocational education costs and benefits. These limitations involve analytical evaluation techniques that relate costs to benefits, methods for measuring costs and benefits, and characteristics of vocational education. Included in the appendixes are abstracts of relevant items from the literature search; bibliographies; and the Delphi survey package, survey results, and panelist comments. (Related reports on individual components of the project are available separately through ERIC--see note.) (MN)

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DESIGN OF A NATIONAL COST-BENEFIT STUDY OF VOCATIONAL EDUCATION AT THE SECONDARY, POSTSECONDARY AND ADULT LEVELS:

FINAL REPORT

BY:

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Dr. Mark Shugoll, Principal Investigator
Mr. Tim Helms, Research Associate

Ms. Dorine Seidman, Contributing Author
Ms. Peggy-Acker Hartman, Contributing Author

Department of Education Contract Number: 300-80-0747

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October 12, 1981

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CHAPTER 1
INTRODUCTION

OVERVIEW

The U.S. Department of Education, Office of Vocational and Adult Education, has contracted with Rehab Group, Inc. for a study assessing the feasibility of performing a national cost-benefit analysis of secondary, postsecondary, and adult vocational education. This report presents the results of the study.

Cost-benefit analysis is one important method for improving resource allocation in the general area of social welfare. This research was conceived as a first step in collecting data that would facilitate more informed decision-making concerning the funding of vocational education. As Federal efforts to balance the budget intensify and funding for social programs becomes scarcer, the results of this and potential follow-up studies become even more timely.

STUDY FOCUS

The central focus of this study is on determining whether a national analysis of the costs and benefits of vocational education is feasible. A number of prior cost-benefit analyses of vocational education have been performed, but they are either local, state, or regional studies. Many of the obstacles to performing a national cost-benefit study of vocational education are shared by these smaller scale analyses. Therefore, a survey of these studies was conducted in an effort to learn from this existing body of research. In addition, a national study may confront unique problems. Thus, a general overview of cost-benefit methodology was carried out in an effort to anticipate these unique problems.

In addition to the central theme of assessing the feasibility of a national cost-benefit study, a series of related issues are addressed in this report. These issues are expressed in the following research questions:

- Will a national cost-benefit study provide useful information to decision makers?
- Is cost-benefit analysis an appropriate methodology on which to base funding decisions?
- What strategy should be used to build a cost-benefit model of vocational education?
- What variables should be included in a cost-benefit model of vocational education?
- What measurement problems would confront a vocational education cost-benefit study team?

The issue of feasibility was not the focal point of the study as originally planned. The Government Request for Proposal called for the design and field test of a preliminary cost-benefit model that later could be implemented on a national basis. After commencing the initial research tasks, the study team, at the urging of the Project Advisory Committee, concluded that field testing a model was premature. First, a thorough examination of the theoretical components of the cost-benefit model must be accomplished. Second, a decision must be made on whether the theoretical model can be operationalized. As a result of these initial conclusions, the scope of work was modified to reflect the current focus.

The results of this study will serve several purposes. First, they will be a determinant of whether additional research on the costs and benefits of vocational education is viable. Second, they will serve as a reference source should a national cost-benefit analysis of vocational education be conducted. Third, they will contribute to the field by summarizing the principal theories, analytical techniques, and measurement problems relevant to performing a cost-benefit analysis of vocational education.

STUDY METHODOLOGY

The determination of whether a national cost-benefit study of vocational education is feasible is based on three primary components:

- A survey of the state of the art of utilizing cost-benefit methodologies to evaluate the returns on investment in vocational education;
- An overview of the potential measurement problems in performing a national study and strategies to overcome or minimize these problems; and
- A Delphi analysis soliciting input from technical experts on the desirability and feasibility of various proposed components of a cost-benefit model of vocational education.

The state of the art and measurement problem components utilized similar methodologies. Both consisted of a comprehensive literature review and consultation with experts on vocational education and cost-benefit analysis. Among the types of literature analyzed were books, journal articles, government studies, and unpublished papers and dissertations dealing with cost-benefit methodologies in general, cost-benefit analysis of vocational education, and cost-benefit analysis in other social welfare areas. Technical experts consulted included economists, vocational educators, mathematicians, Department of Education staff, and practitioners from diverse disciplines who are knowledgable about or have utilized cost-benefit techniques.

Delphi analysis is a survey methodology designed to collect opinions from technical experts on a particular issue. In this case, experts in vocational education and/or cost-benefit analysis were asked to evaluate the variables and measurement difficulties in a proposed cost-benefit model. The specifics of this analysis are explained later in this report.

ORGANIZATION

The report is organized in seven chapters and appendices. Following this introductory chapter, Chapter 2 presents a brief description of the breadth of vocational education. The diversity of the vocational education enterprise has an important impact on the design of a cost-benefit study. Chapter 3 provides an overview of the state of the art of the theory and application of cost-benefit analysis. Chapter 4 explains various analytic approaches that relate costs and benefits in a cost-benefit analysis. Chapter 5 discusses the numerous measurement problems in performing a national cost-benefit study of vocational education. Chapter 6 describes a strategy for building a cost-benefit model, presents a preliminary specification of a vocational education cost-benefit model based on that strategy, and utilizes the Delphi analysis to evaluate the desirability and feasibility of operationalizing the variables specified in the model. Chapter 7 highlights a series of recommendations for future research on the costs and benefits of vocational information.

A number of appendices follow the narrative. Three of these are particularly informative. Appendix A is a series of abstracts of selected outstanding pieces of literature that are relevant to performing a national cost-benefit analysis. Appendix B contains a comprehensive bibliography of cost-benefit and vocational education evaluation literature. Appendix C is a glossary of terms used in cost-benefit analysis of vocational education. The balance of the appendices provide various information on the conduct of this project.

PRIOR STUDY REPORTS

This report presents the results of all tasks conducted over the duration of this project. Three prior papers report the findings of individual study tasks. An assessment of the state of the art in applying cost-benefit methodologies to vocational education appears in the report entitled Design of a National Cost-Benefit Study of Vocational Education at the Secondary, Postsecondary, and Adult Levels: State of the Art Report. An analysis of the measurement problems in performing a national cost-benefit study is presented in Design of a National Cost-Benefit Study of Vocational Education at the Secondary, Postsecondary, and Adult Levels: Cost-Benefit Measurement Report. Recommendations concerning the feasibility of performing a national cost-benefit study were initially reported in Design of a National Cost-Benefit Study of Vocational Education at the Secondary, Postsecondary, and Adult Levels: Cost-Benefit Feasibility Report.

CHAPTER 2

BREADTH OF VOCATIONAL EDUCATION

OVERVIEW

Vocational education, in its broadest sense, can be defined as learning experiences provided to students in one or more skilled, semi-skilled, or technical occupations. However, this very general definition does not accurately reflect the diversity within the vocational education enterprise. Vocational education provides an array of programs and curricula to varied student populations with dissimilar needs through numerous delivery systems on the secondary, postsecondary, and adult levels. This diversity will influence the design of a national cost-benefit analysis of vocational education.

This chapter describes some of the components that contribute to the breadth of vocational education. The first section of the chapter is a discussion of the various program levels on which vocational education is provided and the definitional problems therein. The following section describes the range of program areas encompassed by vocational education. The third section presents the various delivery systems involved in vocational education while the variety of student populations enrolled in vocational programs is treated in the fourth section. A short conclusion appears at the end of the chapter. In the course of describing the various components of vocational education, many of them are defined. These definitions will be utilized throughout the report.

PROGRAM LEVELS

Vocational education may be provided on the secondary, postsecondary, and adult levels. There is much confusion in the use of these terms, particularly concerning the distinction between postsecondary and adult vocational education. As typically used, these categories are not mutually exclusive. For example, an adult who has a high school diploma and is in a matriculating vocational program may be categorized as a postsecondary vocational education student in one state and an adult vocational education student in another. In a third state it is possible that the student might be double-counted.

In an effort to clarify existing definitional confusion, several distinctions between levels are used throughout this report. Postsecondary vocational education is defined as programs provided on an ongoing basis in a post-high school setting that teach job skills to their participants. By comparison, adult vocational education provides specially established, rather than ongoing, courses that are developed to meet the specific occupational or manpower needs of a community or an employer. Adult vocational education courses may be offered in either secondary or postsecondary institutions and are very often taken by individuals desiring to retrain in order to enter a new career or to improve their skills so that they can advance in their present career.

Adult vocational education is also differentiated from adult education in this report. While the former develops job skills, adult education is basic instruction, often in occupational subject areas, that is consumed solely for personal enrichment. Adult education courses may be given in secondary or postsecondary schools, but are apart from the regular matriculating program. The distinction between adult vocational education and adult education is solely definitional and is not meant to diminish the importance of adult education courses. Either program level may be the subject of a cost-benefit analysis.

One final definitional clarification must be made between secondary vocational education and practical arts. Secondary vocational education provides high school level programs that teach occupational skills and prepare a student to hold a job. Practical arts comprises courses that are prevocational, exploratory, and/or for personal consumption by secondary level students.

PROGRAM AREAS

Vocational education is not a uniform educational program teaching occupational skills. Rather, it is a complex offering of diverse courses and program areas. Currently, vocational education lists courses in over 400 instructional categories. Course offerings are often updated in order to respond to technological developments and shifts in occupational demand.

Vocational courses have traditionally been grouped into the following seven major occupational program areas: agriculture, occupational home economics, business and office occupations, trade and industrial occupations, distributive education, health occupations, and technical education.

DELIVERY SYSTEMS

Vocational education is provided in a variety of settings. On the secondary level, vocational courses are taught primarily in general high schools, comprehensive high schools, vocational high schools, and area vocational centers. A general high school teaches courses primarily in general and academic education. It does, however, offer a limited number of vocational programs. A comprehensive high school offers general, academic, and vocational curricula. It is distinguished from a general high school because its vocational offerings are more diverse and extensive. A comprehensive high school must have at least five different vocational programs. A vocational high school specializes in vocational curricula while also teaching academic subjects. All or nearly all of its students are full time vocational education program participants. An area vocational center generally provides only occupational training. A student attending an area vocational center has a dual enrollment, attending the area vocational center part time for vocational curricula and a separate secondary school part time for academic classes. Instruction at an area vocational center is available to residents of a state, county, city, or other geographic area that is usually larger than the local basic administrative unit.

Postsecondary vocational training is available primarily at community colleges, technical institutes, area vocational schools, and proprietary schools. A community college offers two year matriculating programs in both general and vocational education. Like a community college, a technical institute is also a two-year degree-granting institution. However, its curricula is primarily vocational. An area vocational school offers a non-matriculating and exclusively vocational program and provides instruction to students from throughout a particular region. Proprietary schools are private for-profit institutions that usually offer training in a particular occupational area such as business or cosmetology.

Although the above categories are considered the traditional vocational education delivery systems, occupational training may be gained through a number of alternative means. These include cooperative education programs between schools and industry, on-the-job training, apprenticeships, and federally-funded skill centers.

STUDENT POPULATIONS

Vocational education programs are consumed by a variety of populations with differing needs. In addition to the general student population, active participants in vocational education include the following special populations: adults seeking retraining, senior citizens, displaced homemakers, prison inmates, educationally and economically disadvantaged, limited English speaking, and handicapped.

CONCLUSION

Vocational education is a complex enterprise that cannot be simply defined or neatly categorized. It delivers services on secondary, postsecondary, and adult levels; offers over 400 course types in seven occupational program areas; provides technical instruction in a variety of institutional settings; and teaches diverse student populations with varying educational needs.

It is probable that the returns on investment in vocational education differ by program level, program area, delivery system, and/or student population. This hypothesis, particularly concerning program level and program area, is supported by many past research efforts.[1] Therefore, the complexity of vocational education provides a conceptual problem to the design of a national cost-benefit analysis of vocational education. The extent of this problem is discussed in Chapter 5, "Cost-Benefit Measurement Problems."

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[1] Findings for many cost-benefit studies of vocational education are discussed in Chapter 3.

CHAPTER 3

STATE OF THE ART OVERVIEW

INTRODUCTION

This chapter presents a summary of existing cost-benefit studies of vocational education and the literature describing the theory and methodology of cost-benefit analysis. Supplementing this state of the art overview are three appendices which contain abstracts of selected outstanding pieces of literature (Appendix A); a comprehensive bibliography of books, articles, monographs, reports, and unpublished dissertations and papers (Appendix B); and a glossary of terms used in the analysis of vocational education costs and benefits (Appendix C).

The body of literature relevant to evaluating the costs and benefits of vocational education is sizable and multidisciplinary. In order to make this volume of material more manageable, the chapter is divided into five sections. The first section contains a discussion of the methodology of the literature search. The remaining sections present a discussion of the findings and are divided into four areas of concentration. Each deals with theories and issues relevant to performing a national cost-benefit analysis of vocational education. These areas of concentration are:

- Literature on the economics and financing (cost) of vocational education;
- Literature on the methodology of cost-benefit analysis;
- Existing cost-benefit studies of vocational education; and
- Literature on vocational education data bases.

Within the broad area of the economics and financing of vocational education, two particular categories of literature are reviewed. The first is general literature on school finance. This category is important to cost-benefit analysis since an understanding of funding mechanisms is a prerequisite to measuring the costs of vocational education. The second category is literature on educational efficiency and productivity. This area is surveyed because the methodological problems in measuring education inputs and outputs in these studies are analagous to measuring the costs and benefits of vocational education.

Literature on the methodology of cost-benefit analysis includes important theoretical pieces on both cost-benefit analysis in general and cost-benefit analysis in vocational education specifically. The discussion is intended to identify major sources which can provide the reader with background on the theory and technology of cost-benefit analysis.

The third area concerns the application of cost-benefit theory and methodology to vocational education. Studies that measure the costs and benefits of secondary, postsecondary, and adult vocational education are reviewed.

The final area presents literature that analyzes the availability and quality of data on vocational education. The literature in this area is limited. This dearth is of concern since the sufficiency of existing data is a primary determinant of the feasibility of conducting a national cost-benefit study of vocational education.

The state of the art overview chapter and the abstract and bibliography appendices are each divided into the four major organizational areas. Some particular pieces of the research or literature reviewed in this project may properly fall into more than one area. The study team placed each of these pieces in the area considered to be of primary importance. In many instances, this assignment was highly subjective.

Obviously, the amount of literature and the depth of discussion in the overview format of this chapter must be restricted. Greater detail is available, however, in the appendices. The literature abstracts provide more specific information on many of the citations noted in the overview. The bibliographies paint a more complete picture of the multidisciplinary range of existing literature. The glossary defines some of the technical terms used in the overview. Considered together, these components are designed to provide a general awareness of the depth of literature related to cost-benefit analysis of vocational education.

The primary objective of this chapter is to identify and summarize important literature. This identification and summarization process will illuminate many of the strengths and weaknesses of existing cost-benefit designs. This information will, therefore, play a significant role in determining the feasiblity of performing a national cost-benefit analysis.

LITERATURE SEARCH METHODOLOGY

In order to insure the comprehensiveness of the literature search process, a systematic methodology was employed using sequential steps. This process is displayed in Figure 3.1. First, relevant literature sources were identified through consultation with subject matter experts and Department of Education staff, a computer search of the Education Resource Information Clearinghouse (ERIC), and manual searches of university and government libraries. Each bibliographic item was then screened by asking:

- Is it concerned with cost-benefit theory?
- Does it apply cost-benefit methodologies to vocational education?
- If it is concerned with the economics of education or vocational education data bases, will it be useful in the design of a cost-benefit model?

An item was placed in the preliminary bibliography if an affirmative answer was recorded to any of the screening questions. The preliminary bibliography was then reviewed by project staff and subject matter experts for deletion of inappropriate or dated material and notation of exemplary sources. This sequential process of identification, screening, review, and revision was ongoing during the entire course of the study.

LITERATURE ON THE ECONOMICS OF EDUCATION

To fully understand the intricacies of calculating educational costs, some familiarity with school finance mechanisms is necessary. School revenues are raised from local, state, and federal sources. The federal role traditionally has been limited because funding education was not a constitutionally delegated function. However, the federal role has increased somewhat in recent years particularly through categorical programs for disadvantaged and handicapped students.

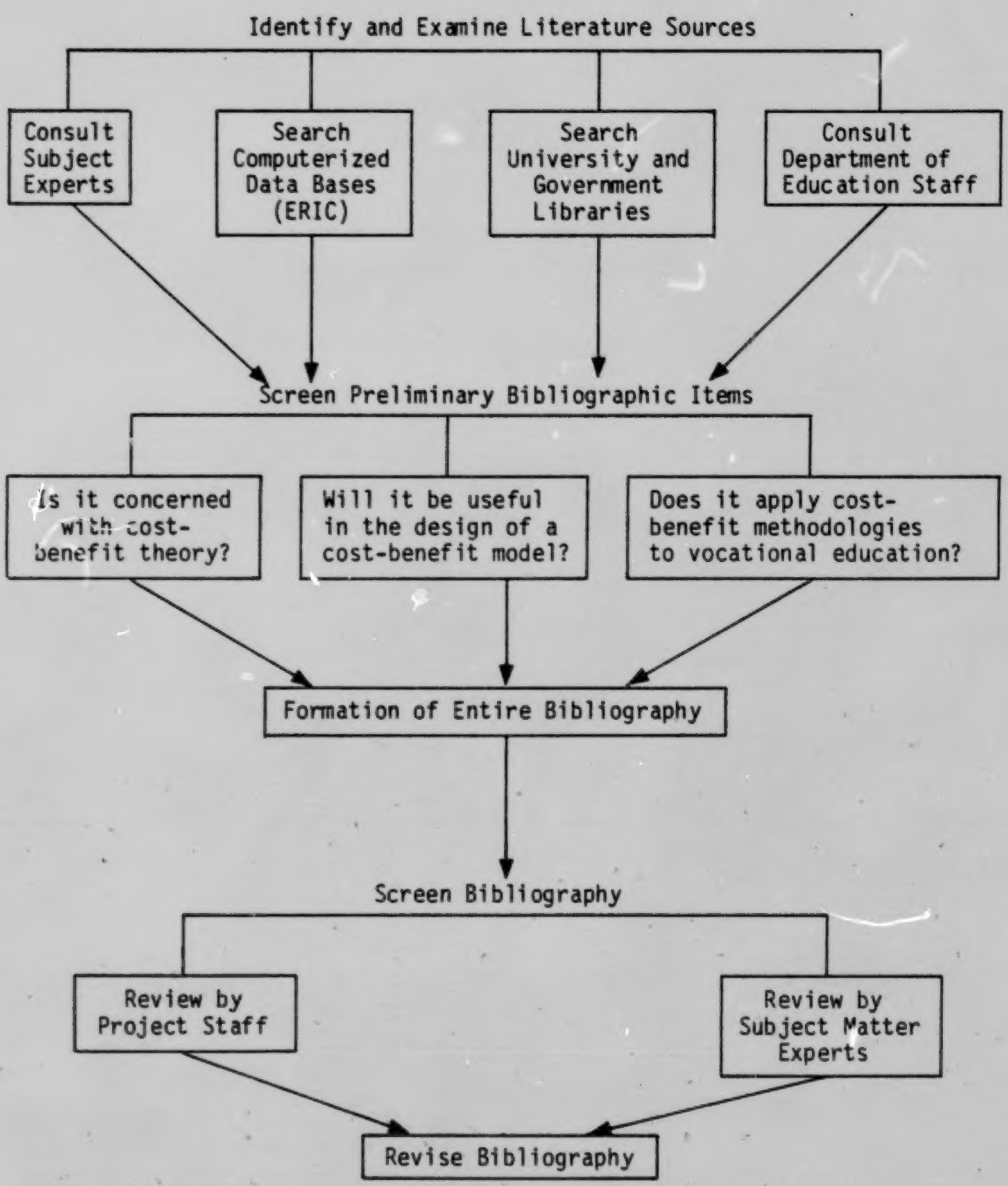
Identify and Examine Literature Sources
Consult Subject Experts
Search Computerized Data Bases (ERIC)
Search University and Government Libraries
Consult Department of Education Staff
Screen Preliminary Bibliographic Items
Is it concerned with cost-benefit theory?
Will it be useful in the design of a cost-benefit model?
Does it apply cost-benefit methodologies to vocational education?
Formation of Entire Bibliography
Screen Bibliography
Review by Project Staff
Review by Subject Matter Experts
Revise Bibliography

Figure 3.1. Literature Review Methodology

Financing education is constitutionally reserved for the states which have instituted a variety of categorical and general aid programs. However, states have delegated much of the administration and fiscal responsibility to localities. Since localities and states are the major actors in school finance, revenue raising structures are quite idiosyncratic, which complicates the measurement of educational costs in a cost-benefit analysis.

The idiosyncracies in school funding are primarily reflected in the diverse approaches taken by states to finance public education. The history of state aid to education can be traced through the writings of Cubberly (1906), Strayer and Haig (1927), Mort (1933), Updegraff and King (1922), and Morrison (1930). Cubberly was the first person to seriously challenge the use of flat grants to fund education. He contended that a more flexible system was needed that recognized differences in district wealth and tax effort. The writings of Strayer and Haig became the basis for the most widely used of today's state assistance programs, the Minimum Foundation Plan. Under this plan, the state establishes a level of revenues per pupil that it feels is necessary for a satisfactory minimum education program. Using a fixed tax rate, the state computes each school district's ability to pay and provides to localities the difference between this level and the guaranteed minimum level. Much of the work of defining an adequate minimal education and the different needs of local districts is attributable to Mort. Updegraff and King advocated a variation of the Minimum Foundation Plan called Percentage Equalizing, while Morrison supported full state assumption of educational funding, a plan which has been implemented only in Hawaii.

Interest in school finance increased dramatically after the California Supreme Court initially ruled in the 1971 case of Serrano v. Priest. The Court contended that the state's school finance structure was unconstitutional since severe revenue disparities existed between school districts. The primary reasons for these revenue disparities were a strong reliance on the local property tax for educational funding and large inequalities between localities in property tax base. The Serrano case prompted Berke and Kirst (1972) to document the extent of revenue disparities across the country and to prescribe mechanisms to finance equal educational opportunity. An outstanding overview of the problems and remedies in school finance appears in Reischauer and Hartman (1973). Other excellent texts on the funding of public schools were authored by Johns, Alexander and Jordan (1972), Berke, Campbell, and Goettel (1972), and Cohn (1974).

McLure (1976) discusses school finance issues in relation to special education programs in Illinois. This analysis includes an evaluation of the administrative and financial structures of vocational and bilingual education, as well as more traditionally defined special education programs such as those for learning disabled and handicapped students.

An additional area of research performed by educational economists that should be reviewed by those interested in cost-benefit analysis is production function studies. Since cost-benefit analysis is essentially an input (costs) - output (benefits) methodology, it shares many of the same problems as educational production function research.

A production function analysis relates quantities of inputs to one or more outputs. This technique is used primarily by educational researchers to identify what educational inputs (e.g., teacher experience, school facilities, student-teacher ratio) have the greatest influence on educational output. The most well known of this type of production function study is Equality of Educational Opportunity (Coleman, 1966).

Among the common concerns of cost-benefit and production function methodologies is controlling for non-educational variables that affect learning levels. These variables include innate ability (often measured by I.Q. scores), the richness of the home environment (measured, for example, by the number of books and magazines in the home), and family background (often measured by parents' income and educational background).

In cost-benefit analyses that compare the returns of vocational education to those of non-vocational education, a basic consideration is selecting comparison groups that are similar on these influential non-educational variables. Since matching vocational students with general education students on social background variables is difficult, researchers often utilize regression techniques to control for non-educational impacts.

In production function research, analysts are faced with the similar dilemma of partialing out confounding non-educational variables in order to examine the contribution of alternative educational inputs to educational performance. This is done primarily by regressing educational output against a variety of school and non-school variables. For example, Bowles (1970) hypothesizes an educational production function as:

$A = f(X_1 \ldots X_m, X_n \ldots X_u, X_w \ldots X_z)$, where

A = School output

$X_1 \ldots X_m$ = School inputs

$X_n \ldots X_u$ = Non-school environmental influences

$X_w \ldots X_z$ = Student's initial learning level prior to entering school

By statistically controlling the regression analysis for non-school environmental influences and a student's initial learning level, Bowles separates out the effect of school inputs on output and measures the "value added" by these inputs.

A second common concern of production function and cost-benefit analyses is measuring the end-products of the educational process. In cost-benefit analysis, one primary measurement difficulty is operationalizing non-pecuniary, as opposed to economic, benefits. In production function research, the methodological problem is identical but the terminology is different. Researchers find it difficult to measure the consequences, outcomes, or final goals of the production process (such as non-cognitive educational skills) while they are much more successful in measuring the direct outputs or intermediate goals of the production process (such as test scores and dropout rates) (Bradford, Malt, and Oates, 1969).

A third problem shared by the two methodologies is controlling for differences in program quality. It is theoretically inadequate merely to compare the quantity of output of various educational programs since the quality of the outputs may differ also. Both production function and cost-benefit researchers have attempted to adjust for quality differences by introducing proxy variables such as pupil/teacher ratio and teacher experience on the input side of the regression equation. An outstanding discussion of this process and its methodological limitations is found in Ross and Burkhead (1974).

Numerous production function analyses exist using similar regression techniques but varying measures of educational outputs and inputs, quality proxies, data bases, and levels of sophistication. Many of these studies (Burkhead, Fox and Holland, 1967; Katzman, 1968; Shaycoft, 1967) analyze production functions for schools in various cities. Others (Cohn, 1968; Raymond, 1968; Kiesling, 1970) use school districts rather than schools as the unit of analysis. The Shaycoft study is unique because it used longitudinal data. Shaycoft utilized Project Talent data to accumulate information on 6,583 ninth grade students. He later gave these same students a variety of achievement tests when they were in the twelfth grade. Noting the rise in achievement while controlling for socioeconomic status, Shaycoft concluded that schooling does affect pupil performance.

Among the more sophisticated input-output designs are a series of studies that create simultaneous equations to analyze production (Fox, 1969; Levin, 1970; Michelson, 1970; Averch and Kiesling, 1972; Brown, 1972). In a study of educational production in Chicago schools, Fox used two measures of school output, with each dependent variable entering the other equation as an independent variable. The logic behind this methodology is that the multiple goals of an education system are interdependent and, therefore, schools trade off between the alternative outputs. Michelson and Brown both used two-stage least squares to estimate their simultaneous equations. Levin used two-stage least squares, ordinary least squares, and reduced form estimates.

One study created a non-linear production function similar to a Cobb-Douglas equation (Hanushek, 1970). Hanushek regressed verbal scores against twelve socioeconomic and school variables using a double log specification.

There are so many commonalities between cost-benefit and production function techniques that the preceding literature can be extremely useful in the design of cost-benefit models. A review and critique of much of this work may be found in Averch, Carroll, Donaldson, Kiesling, and Pincus (1974).

LITERATURE ON COST-BENEFIT AND EDUCATION EVALUATION THEORIES

Cost-benefit analysis is a sophisticated evaluative technique. One of the most interesting presentations of the methodological components of cost-benefit analysis as well as the uses, problems, and limitations of the technique is Mishan (1976). Mishan discusses such issues as opportunity costs, shadow pricing, externalities, and discount rates. Other general discussions of cost-benefit methodology include Prest and Turvey (1965), Rothenberg (1975), Musgrave and Musgrave (1976), and Sum, Mazyed, McLaughlin and Zornitsky (1978).

Hu and Stromsdorfer (1979) analyze many of the problems in cost and benefit measurement of vocational education. Of particular interest is their contention that joint costs are not a measurement problem in cost-benefit analysis. They explain that when a school is operating at less than capacity, use of a facility by one person does not preclude use of the facility by another. Therefore, the marginal cost of using the facility is zero, and adjustment for joint costs is unnecessary.

Davie (1967) explains three criteria for making benefit-cost decisions in the context of vocational education: the present value of net benefits, the rate of return, and the benefit-cost ratio. Kaufman (1969) discusses the logic and meaning, misconceptions, and problems and limitations of cost-benefit methodology in vocational education. Stromsdorfer (1967) explains, among other issues, the computation of opportunity costs, the problems in selecting a discount rate, and the danger of double-counting the benefits of vocational education since such intangible benefits as increased mobility may be already reflected by increased earnings.

Cardus, Fuhrer, and Thrall (1980) write in the area of rehabilitation research rather than vocational education. However, they suggest some means of measuring non-pecuniary benefits which should be of interest to vocational educators. Non-pecuniary benefits have traditionally been the major measurement difficulty in cost-benefit analyses of vocational education.

Hansen and Weisbrod (1969) discuss cost and benefit measurement in relation to public postsecondary education. Other studies presenting the principles of cost-benefit analysis in the context of vocational education are those of Peterson (1969) and Reinhart and Blomgren (1969).

A methodology that parallels cost-benefit analysis is cost-effectiveness research. The primary difference between the techniques is that cost-effectiveness analysis expresses results in terms of physical or psychological outcomes rather than economic values. The theories and applications of cost-effectiveness are explained by English (1968), Forbes (1964), Levin (1975), and Blaschke and Sweeny (1976).

Kim (1976 and 1977a) has designed models that combine techniques of cost-benefit analysis with those of cost-effectiveness analysis. These models can generate three kinds of program measures: program effectiveness, cost-efficiency, and a cost-effectiveness and performance ratio. He has developed separate theoretical models for secondary and postsecondary vocational education.

In order to perform either cost-benefit or cost-effectiveness analysis, measurable benefits of the vocational education process must be specified. Darcy (1980) contributes to this identification process by defining 15 vocational education outcomes and discussing their use in evaluation research. These benefits are both economic and non-economic, and some can be measured far more accurately than others for research purposes. Two research efforts that help identify primary methodological issues on the cost side of cost-benefit analysis were conducted by Hale, Starnes, and Mickler (1977) and Mohrenweiser (1979).

LITERATURE ON COST-BENEFIT APPLICATIONS IN VOCATIONAL EDUCATION

Numerous researchers have applied the concepts of cost-benefit analysis to vocational education. A number of very useful reviews of this literature exist (Warmbrod, 1968; Stromsdorfer, 1972; Adams, 1972; Hu, 1980; and Mertens, McElwain, Garcia, and Whitmore, 1980). Hu's paper investigates some of the major measurement problems in cost-benefit analysis of vocational education and summarizes the literature. Mertens, et al. surveys existing cost-benefit literature in the process of analyzing whether research findings are consistent concerning the impact of vocational education on certain output variables. A separate review is performed for secondary and postsecondary vocational education. Adams presents an excellent overview of research on adult vocational education prior to 1972.

Until the early 1970's, most cost-benefit studies limited their scope to analyzing the effect of vocational education in one or more cities. Corazzini (1966), for example, examined the costs and benefits of public vocational education in Worcester, Massachusetts. Kaufman and Lewis (1968) focused on three Pennsylvania cities. Taussig (1968) compared the impact of vocational and academic high school programs in New York City. Hu, Lee, Stromsdorfer, and Kaufman (1969) contrasted the returns from secondary vocational education with comprehensive secondary programs in Philadelphia, Detroit, and Baltimore.

These studies have been followed by numerous analyses on a statewide basis. These include cost-benefit analyses in Michigan (Cohn, Hu, and Kaufman, 1972), Florida (Harris, 1972), Kansas (DeVore and Scott, 1974), Wisconsin (Webb, 1974), Missouri (McNelly and Kazanus, 1975), Illinois (Nystrom and Hennessey, 1975), Ohio (Ohio State Department of Education, 1975), New Jersey (Doty, 1976), and Massachusetts (Conroy and Diamond, 1976).

Only a handful of studies have been attempted that are more national in scope. These include Fernback and Somers (1970), Eninger (1972), and Lee (1976).

Although studies of secondary vocational education predominate in the literature, there are a variety of important postsecondary and adult analyses. Carroll and Ihnen (1966) studied the economic effects of technical education at a two-year postsecondary school in North Carolina. Included in the analysis performed by Marson, Weiner, and Sorenson (1977) are 63 adult education courses from three vocational schools. Works by Koch (1972), Osburn and Richardson (1974), and Kastner (1976) are representative of other adult and postsecondary studies.

The cost of vocational education may be measured using either average cost or marginal cost methods. Most of the research to date, whether secondary, postsecondary, or adult analyses, measures the costs of vocational education as average costs. Among the analyses employing marginal cost methods are Cohn, Hu, and Kaufman, Osburn and Goishi (1974), and Swanson (1976).

The issue of joint costs is considered in a limited number of studies. Aldrich (1972) proposes three alternative criteria for calculating joint costs: the number of student credit hours, the number of full-time equivalent faculty, and classroom square footage. Hu, Lee, Stromsdorfer, and Kaufman ignore joint cost measurement because they believe that one student utilizing a facility does not deny similar usage by other students. Therefore, the joint costs are equal to the marginal costs of facility usage which are zero.

On the benefits side, measurement difficulties have limited the majority of analyses to the consideration of economic benefits only. Economic benefits are predominately measured by the level of worker earnings. Hu, Lee, Stromsdorfer, and Kaufman, and Swanson, utilized both earnings and wage rates as measures of economic benefits.

Hamby, Harper, and Myers (1978) performed a cost-benefit analysis in Montana that did attempt to include non-pecuniary benefits. Those were measured by perceptions of vocational and non-vocational students on the utility of their training, by employers' assessment of the quality of their employees' training, and by comparisons of the vocational and non-vocational students' perceptions of the quality of their life.

Hu, Lee, Stromsdorfer, and Kaufman likewise included measures of non-pecuniary benefits in their research. They utilized citizenship (measured by voting participation) and job relatedness to one's education program. Their findings show that vocational education is more job relevant than non-vocational education but that no differences exist between vocational and non-vocational graduates in voting participation.

Marson, Weiner, and Sorenson developed numerous measures of private and social non-pecuniary benefits for their study on vocational-technical adult education graduates. These included student study habits, personality traits, self-assessments of ability, attitudes toward education and employment, help from the school in job placement, permanence of job, job satisfaction, involvement in community organizations, number of promotions, and length of job search.

Galloway and Ghazalah (1972) also measured the impact of vocational education on non-pecuniary benefits. Their measures included job satisfaction, work attitude, communication skills, interpersonal relationships, and self-confidence.

The Swanson and the Kaufman and Lewis studies used job satisfaction as a measure of non-pecuniary benefits. Karnes (1966) used holding power, which is the inverse of the dropout rate, as a measure of educational benefits in his study of the impact of vocational training on slow learners who are potentially high dropout risks. Other studies employing various measures of non-pecuniary benefits were performed by Eninger, Webb, Lee, and Harris.

The findings of many studies highlight the dangers of over-aggregation in cost-benefit analyses. Results very often differ by program area, level of education, type of institution, and sex of the student. For example, Cohn, Hu, and Kaufman (1972) found that the added costs of secondary vocational education (costs above those necessary to fund non-vocational education) vary greatly by program area. The average added cost of a welding curriculum was $365. However, a home economics curriculum actually cost $15 less than a general education curriculum. In his comparision of the costs of a basic high school curriculum with a vocational curriculum, Corazzini found that there were differences between the cost of vocational education programs selected by boys and by girls. Conroy and Diamond's results show that male vocational graduates earned more and found jobs more quickly than non-vocational program graduates. No differences were observed on these variables between female vocational and general education students. Fernback and Somers' data suggest that while the net benefits of secondary vocational programs were positive, they were negative for postsecondary vocational training. Harris' research found that the rates of return of vocational education differ between secondary and postsecondary programs. He also showed that rates of return vary by program area. Swanson concluded that the efficiency of vocational training, calculated as benefit-cost ratios, varied by program area. While many training programs had positive benefit-cost ratios, the ratios for some particularly costly programs were negative.

The conclusions of cost-benefit studies of vocational education vary over time. The early studies concerning the influence of vocational education on earnings were inconclusive. Taussig, for example, found the rate of return on investment in vocational education to be quite small and the present value of benefits to be negative. However, Eninger's early study showed a rate of return twice as great as Taussig's and a positive net present benefit of $307 per student.

Later studies, however, have consistently demonstrated that the economic returns from vocational training are positive. For example, McNelly and Kazanus calculated benefit-cost ratios for secondary vocational education as high as ten to one. Koch estimated the private rate of return of postsecondary vocational training as 12.3 percent. Other studies conclude that vocational education can lead to increased earnings, greater job satisfaction, greater levels of employment, reduced job search time, and higher overall satisfaction with one's educational program.

LITERATURE ON VOCATIONAL EDUCATION DATA SOURCES

The decentralized structure of the American education system often creates data difficulties for educational evaluators and cost-benefit study teams. Data quality and data availability vary sharply across states and even within states. There are a number of resources that review the availability and quality of vocational education data.

Brown, Barns, Currence, and Henderson (1980) are the authors of an Office of the Assistant Secretary for Planning and Evaluation (ASPE) overview of vocational education research and data sources. They found a distinct difference between data bases. Of superior value, according to the analysis, are the High School and Beyond Longitudinal Survey, the National Longitudinal Study of the High School Class of 1972, the Berkeley Survey of Vocational Schools in 10 States, and the 1966 National Longitudinal Survey. Rated particularly deficient are the Bureau of Occupational and Adult Education Annual Statistical Reports and the Vocational Education Data System (VEDS). The conclusion concerning VEDS is most interesting since the data collection system was designed to overcome many existing data problems.

Lee (1979b) describes the characteristics of vocational education data at the local, state, and Federal levels. In the process, he discusses the reasons for the highly inconsistent quality of vocational education data. Lee (1979a) also discusses how vocational educators can use existing evaluative data.

Hopkins (1979) summarizes the information needs, data sources, and data deficiencies in vocational education. Of particular use is an appendix which matches various data elements with the data sources from which they are available.

Grasso and Shea (1979) review the availability of data from several national surveys. Included in their discussion are the Project Talent Data Base, Youth in Transition, National Longitudinal Surveys, and National Longitudinal Study of the High School Class of 1972.

Other surveys of data availability or discussions of data sources may be found in works by Vatz (1976), Pucell (1979), and Woods (1980). The latter two sources are concerned with the use of longitudinal data sets in vocational education evaluation.

A second category of useful literature discusses the existence and future potential of management information systems in vocational education. Morgan, Ballenger, and Lawrence (1974) and Starr, Black, and Gray (1977) both surveyed the availability of vocational education management information systems on a national level. Mendenhall (1977) writes about the vocational education information system in the State of Nebraska.

Various documents discuss the use of particular vocational education data sets. For example, Flanagan, Dailey, Shaycoft, Orr, and Goldberg (1962) wrote about the Project Talent data. Other pieces describe the Youth in Transition data (O'Malley, Buchanan, and Johnston, 1977); the National Longitudinal Survey (Fetters, 1975; Tabler, 1976); the National Longitudinal Study of the High School Class of 1972 (Echternacht, 1975); and the Project Baseline Data (Lee, 1974, and Peng, Stafford, and Talbert, 1976).

Ghazalah (1981) proposes that evaluators of vocational education and cost-benefit study teams utilize existing sources of data to a greater degree, rather than data collected through personal surveys. One underutilized data resource is U.S. Individual Tax Returns filed with the Internal Revenue Service. Ghazalah shows how these data can be used as a source of vocational student earnings as well as providing proxy variables for employment rates and interregional mobility.

CHAPTER 4

REVIEW OF COST-BENEFIT ANALYSIS

OVERVIEW

Cost-benefit analysis is an evaluative process which relates the benefits of an investment choice to the costs associated with actualizing that investment. It differs from cost-effectiveness analysis which evaluates the cost-effectiveness of various options in obtaining a predetermined goal. Cost-effectiveness analysis can suggest that option A is more cost-effective than option B in obtaining desired goal C. However, this analytic procedure produces no absolute statement about the worth of goal C. In contrast, cost-benefit analysis attempts to quantify the merits of a proposed investment and relates those merits to the costs involved.

Four basic techniques have been developed for comparing the costs and benefits of an activity or potential investment alternative. These four techniques, which may be employed by a national cost-benefit study team, are discussed in the following section. The chapter concludes with a discussion of the limitations of each of the four cost-benefit analysis techniques.

ANALYTIC APPROACHES

The most obvious approach to relating costs and benefits is to sum all the costs and benefits of a program and compare them. This comparison may be performed, for example, by subtracting costs from benefits (simple net benefit method) or by dividing benefits by costs (simple benefit-cost ratio). An investment or activity is worthwhile under the simple net benefit method if the difference is positive, or under the simple benefit-cost ratio method if the quotient is greater than one. Should more than one investment option be available, both methods could be used to rank order the desirability of the available options. However, the two methods may not rank the options consistently. This is illustrated in Table 4.1, which displays the expected costs and benefits of six investment options and calculations of their simple net benefit and their simple benefit-cost ratio.[1] Both evaluation methods would exclude option E from the set of desirable investments. This is indicated by the negative value for the simple net benefit and the simple benefit-cost ratio being less than 1. Of the viable investments, the simple net benefit method would rank option A as the most desirable since it has the greatest positive value. In contrast, investment option D has the highest ratio and, therefore, is ranked first by the simple benefit-cost ratio method.

Table 4.1
Comparison of Investment Options Using the Simple
Net Benefit and Simple Benefit-Cost Ratio Evaluation Methods

	Expected Costs	Expected Benefits	Evaluation Method	
Investment Option	$\sum_{t}^{N} C_t$	$\sum_{t}^{N} B_t$	Simple Net Benefit $\sum_{t}^{N} (B_t - C_t)$	Simple Benefit-Cost Ratio $\sum_{t}^{N} B_t/C_t$
A	$100	$110	$10	1.10
B	50	55	5	1.10
C	100	105	5	1.05
D	60	69	9	1.15
E	100	90	-10	0.90
F	50	56	6	1.12

Both the simple net benefit and simple benefit-cost ratio evaluation methods have serious limitations as analytic approaches. The former method does not indicate the efficiency of an investment (returns relative to cost). The latter method does calculate the efficiency of an investment but does not directly indicate the net benefit to be gained by an investment. An additional limitation of this technique is that it depends on a distinction between costs and negative benefits. Costs are generally assumed to be expenditures incurred in operating a program. Negative benefits are generally outcomes resulting from vocational education which have a negative impact (for example, workers being displaced by automation). However, the distinction between costs and negative benefits is often vague and an argument can be made for entering a particular term on either the cost side of an analysis or the benefits side of an analysis as a negative benefit. For instance, downstream operating costs that result from the implementation of a program may also be considered a negative benefit of a program. This is important because the magnitude of the simple benefit-cost ratio may be significantly affected by this distinction.[2]

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[1] For the ease of example, all investment options are assumed to be riskless.

The major deficiency with both the simple net benefit and simple benefit-cost methods is that neither accounts for differences in the flow of benefits and costs over time. Therefore, two investment options each costing $100 and yielding benefits totalling $125 would be ranked equally by the simple net benefit and simple benefit-cost ratio methods even if the second investment took twice as long to yield the same benefits. Since a typical consumer prefers immediate income to the same amount of income in the future (termed a positive rate of time preference) the first investment option clearly appears to be the more attractive. Four basic evaluative methods which attempt to account for this positive rate of time preference are discussed in the following sub-sections.[3]

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[2] Perhaps this point is best illustrated by example. Assume there is an investment plan with positive benefits valued at $300, negative benefits valued at $50, and direct costs of $100. The simple benefit-cost ratio (B_t/C_t) will compute different values depending on how one treats negative benefits. If they are considered on the benefits side of the equation, a ratio of 2.5 is computed:

$$(300-50)/100 = 2.5$$

If negative benefits are considered a component of cost, a ratio of 2.0 is achieved:

$$300/(100+50) = 2.0$$

As this example illustrates, the interpretation of negative benefits may alter the valuation of an investment.

[3] A more thorough discussion of the rate of time preference and associated measurement difficulties is presented later in Chapter 5 of this report.

Payback Period

The payback period method calculates the length of time required by an investment alternative to recover its costs. Investment alternatives are then ranked inversely to the duration of this payback period. Therefore, positive rates of time preference are recognized since a shorter payback period is considered superior to a longer payback period. This method is represented equationally, when solving for N, by:

$$\sum_{t=0}^{N} B_t - \sum_{t=0}^{N} C_t = 0, \text{ where}$$

N = the total number of time periods
B_t = the benefits occurring in time period t
C_t = the costs incurred in time period t.

There are two major deficiencies with this method. First, it disregards any benefits or costs occurring after the time period when the sum of the benefits equals the sum of the costs. Second, the methodology does not distinguish between differences in the timing of benefits enroute to equaling costs. Table 4.2 helps clarify these points.

Using the payback period evaluation methodology, all three options depicted in Table 4.2 would be ranked equally since in each case the total cost of investment ($100 dollars) is recouped by the second time period. However, everything else being equal, investment option B appears to be the most desirable since an additional return of $50 in benefits occurs after the point where the benefits from the investment equal the costs. Therefore, the total benefits through the third time period are greatest under investment option B. Illustrative of the second objection to this methodology is that the payback period does not distinguish between options A and C although A is apparently superior to C because more of the returns occur sooner. ($90 in the first time period for investment option A and $10 in the same time period for investment option C.)

Table 4.2
Comparison of Investment Options Using the
Payback Period Evaluation Methodology

Investment Option	Total Cost of Investment $\sum_{t=0}^{N} C_t$	Sum of Total Benefits Over Time $\sum_{t=0}^{1} B_t$	$\sum_{t=0}^{2} B_t$	$\sum_{t=0}^{3} B_t$
A	$100	$ 90	$100	$100
B	100	90	100	150
C	100	10	100	100

An additional deficiency of the payback period method is its implication that projects should be evaluated upon the speed with which they can recover costs. Investors are not interested in merely recovering their costs. Rather, they desire to maximize their benefits. Further, investments are not justified on the basis of recovering initial costs. For example, as shown in Table 4.2, options A and C both recover their costs, assuming that all benefits are measured and no benefits occur after the third time period. Neither investment is justified on this basis because the $100 in benefits resulting by the second time period would be valued less, given a positive rate of time preference, than the $100 worth of consumption foregone to make the investment.

As the preceding discussion suggests, the payback period method has severe limitations. For these reasons it is seldom employed in cost-benefit analysis. This method is appealing based on its conceptual simplicity, but suffers from its inability to specifically account for time preferences of consumption. Three more satisfactory methodologies are discussed in the following sub-sections.

Net Present Value

The net present value (NPV) method is one of the most commonly used techniques to relate costs and benefits. It is fundamentally similar to the simple net benefit method but also incorporates a factor for time preference. It shares a basic characteristic of the simple net benefit method in that it indicates the value but not the efficiency of an investment. This method is represented by:

$$NPV = \sum_{t=0}^{N} \frac{B_t - C_t}{(1+i)^t}, \text{ where}$$

N = the total number of time periods
$B_t - C_t$ = the net benefits occurring in time period t
i = the social rate of discount.

The net present value method subtracts costs from benefits for each time period and then adjusts the net figure to a present value. As can be seen from the equation, the adjustment factor, 1+i, grows at an exponential rate. Therefore, the size of i significantly affects the magnitude of the calculated net present value. In particular, the larger the magnitude of i, the higher those projects with most of their benefits accruing early will be evaluated. Table 4.3 helps illustrate this point.

Table 4.3
Comparison of Investment Options Using the Net
Present Value Evaluation Methodology

Investment Option	Net Benefits Per Time Period				Net Present Value Criterion		
	B_0-C_0	B_1-C_1	B_2-C_2	B_3-C_3	i =0.0	i=0.1	i=0.2
A	$-100	$150	$0	$0	$50	$36	$25
B	-100	55	55	55	65	37	16
C	-100	0	0	170	70	28	-2

Table 4.3 shows that the choice of the appropriate value for i may have significant impact on the ranking of alternate investments. For example, investment option C is ranked the highest (the net present value equals $70) assuming i equals zero. However, it returns a negative net present value (-$2) when a time preference of 20 percent (i=.2) is assumed. The reader

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should also notice that when i equals zero, the net present value criterion ranks the investment options exactly the same as the simple net benefit method since both assumed either implicitly (the simple net benefit method) or explicitly (the net present value method when i equals zero) a zero rate of discount.

Benefit-Cost Ratio

The benefit-cost ratio (BCR) is theoretically similar to the net present value method: Both methods discount the flow of costs and benefits to their present values. The benefit-cost ratio divides the present value of the benefits by the present value of the cost. This procedure is equationally represented by:

$$BCR = \frac{\sum_{t=0}^{N} \frac{B_t}{(1+i)^t}}{\sum_{t=0}^{N} \frac{C_t}{(1+i)^t}} \text{, where}$$

N = the total number of time periods
B_t = the benefits occurring in time period t
C_t = the costs incurred in time period t
i = the social rate of discount.

The resulting value is an indicator of the efficiency of an investment.

The benefit-cost ratio exhibits the same general properties of the simple benefit-cost ratio discussed previously except that all future benefits and costs have been discounted to their present values. In particular, the benefit-cost ratio does not reveal the amount of money to be gained from an investment and is susceptible to various interpretations of negative benefits.

A research team directed by David Cardus, Marcus Fuhrer, and Robert Thrall has developed an interesting adaptation of the traditional benefit-cost ratio.[4] They suggest that making a distinction between current year budget requirements and other future program costs may, in many instances, lead to a more efficient allocation of an agency's current year budget among competing alternatives. They use the term critical costs (CC) in their study which is defined as "the amount of the current...budget that is required to fund [a] project."[5] Other program costs (CO) may include "set-up costs, operational costs, and also downstream...(program) funding."[6] Equationally, total costs (C) are represented by:

$$C = CC+CO.$$

Cardus, Fuhrer, and Thrall have proposed that in many instances when there are both present costs and downstream costs, a more appropriate method to relate costs to benefits is represented by:

$$\frac{NPV}{CC} = \frac{\sum_{t=0}^{N} \frac{B_t-C_t}{(1+i)^t}}{CC}, \text{ where}$$

N = the total number of time periods
B_t-C_t = net benefits occurring in time period t
i = social rate of discount
NPV = net present value
CC = critical costs.

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[4] These findings are reported in D. Cardus, M.J. Fuhrer, R.M. Thrall, et al., A Benefit-Cost Approach to the Prioritization of Rehabilitative Research (Houston, TX: Baylor College of Medicine, the Institute for Rehabilitation and Research), 1980.

[5] Cardus, Fuhrer, and Thrall, p. 82.

[6] Cardus, Fuhrer, and Thrall, p. 82.

The idea represented by this equation is to calculate the net present value of the expected benefits from an investment alternative. If these net expected benefits are positive (or as the study team points out, significantly positive[7]), the project would be a worthy investment choice, given unlimited funds. These net benefits should then be divided by the project's critical costs to provide a ranking of the relative merit of the various investment alternatives.

Cardus, Fuhrer, and Thrall provide several examples in which their expected net benefits-critical costs ratio is preferred to the traditional benefit-cost ratio. They also readily admit that this evaluation method has numerous shortcomings.

Rate-of-Return

The values generated by both the net present value and the benefit-cost ratio methods depend upon the selection of the rate-of-time preference. This may be considered a deficiency because the magnitude of the discount rate significantly affects the valuation of an investment option and, yet, considerable controversy exists over the appropriate value for the discount rate. The rate-of-return method (RR) successfully circumvents this problem by establishing a rate of discount which equates the flow of benefits and costs over time. This is represented equationally by:

$$RR = r \text{ such that } \sum_{t=0}^{N} \frac{B_t - C_t}{(1+r)^t} = 0, \text{ where}$$

N = the total number of time periods
$B_t - C_t$ = net benefits occurring in time period t
r = the rate-of-return.

Investment options can be ranked by the magnitude of r, with an investment yielding a larger r preferred to an investment yielding a smaller r.

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[7] Estimated net benefits are "significantly positive" when they are great enough to assure the evaluator that their positive nature is not solely the result of possible measurement errors.

Table 4.4 gives the valuation of 12 investment options using the rate-of-return method. For comparison, the valuation of these investments has also been illustrated using the payback period, net present value, and benefit-cost ratio methods. Three valuations are provided for the net present value and benefit-cost ratio methods. Each reflects different assumptions concerning the rate of discount.

Investment option A provides a rate-of-return of 20 percent. In other words, the value of 0.2 for r equates the values of the cost and benefit streams over time.[8] The rates-of-return have been calculated in a similar manner for the other investment options.

The utility of the rate-of-return method is that this rate can be compared to an individual's personal rate of time preference. If the calculated rate-of-return exceeds the individual's personal rate of time preference, the investment is worthwhile.

The rate of return method does have some limitations. One relatively minor criticism of the method is that for some investments, more than one value for the discount rate will equate the values of the cost and benefit streams. This may occur when costs exceed benefits in more than one period or when an investment yields benefits which accrue over more than two periods.

SUMMARY

As the preceding discussion suggests, there are numerous mechanisms to relate costs and benefits in a cost-benefit analysis. Each has particular strengths and limitations which are summarized in this section.

The simple net benefit method and the simple benefit-cost ratio method suffer because they do not account for the positive rate of time preference for most individuals. A positive rate of time preference assumes that a

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[8] This is shown in the following calculation:

$$-100/(1+.2)^0 + 120/(1+.2)^1 = -100/1 + 120/1.2 = 0$$

Table 4.4
Comparison of Investment Options Using the Rate-of-Return Evaluation Methodology

Invesment Option	Expected Net Benefits[1] $B_0 - C_0$	$B_1 - C_1$	$B_2 - C_2$	$B_3 - C_3$	$B_4 - C_4$
A	$-100	$120.0	$ 0.0	$ 0.0	$ 0.0
B	-100	120.0	20.0	20.0	20.0
C	-100	50.0	50.0	0.0	0.0
D	-100	55.0	60.5	0.0	0.0
E	-100	60.0	72.0	0.0	0.0
F	-100	45.4	41.3	0.0	0.0
G	-100	25.0	25.0	25.0	25.0
H	-100	27.5	30.2	33.3	36.6
I	-100	30.0	36.0	43.2	51.8
J	-100	22.7	20.7	18.8	17.1
K	-100	72.0	60.0	0.0	0.0
L	-100	0.0	0.0	0.0	0.0

Investment Option	Payback Period	Net Present Value			Benefit-Cost Ratio[2]			Rate-of-Return
		i=0	i=.1	i=.2	i=0	i=.1	i=.2	
A	1	$20.0	$ 9.1	$ 0.0	1.2	1.1	1.0	20%
B	1	80.0	54.3	35.1	1.8	1.5	1.4	49
C	2	0.0	-13.2	-23.6	1.0	0.9	0.8	0
D	2	15.5	0.0	-12.2	1.2	1.0	0.9	10
E	2	32.0	14.0	0.0	1.3	1.1	1.0	20
F	-	-13.3	-24.6	-33.5	0.9	0.8	0.7	-10
G	4	0.0	-20.8	-35.3	1.0	0.8	0.6	0
H	4	27.7	0.0	-19.1	1.3	1.0	0.8	10
I	4	61.0	25.0	0.0	1.6	1.2	1.0	20
J	-	-20.7	-36.5	-47.6	0.8	0.6	0.5	-10
K	2	32.0	15.0	1.7	1.3	1.1	1.0	21
L	4	46.4	0.0	-29.4	1.5	1.0	0.7	10

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[1] For ease of example, all costs are assumed to occur in the period of initial investment.

[2] Since there are no downstream costs in this example, the ratio created by Cardus, Fuhrer, and Thrall would be identical to the benefit-cost ratio minus one.

typical consumer prefers immediate income to the same amount of income in some future time period. If for no other reason, $100 today is preferred to $100 a year from now because money on hand can be invested in a "riskless" asset and return $100 plus interest in one year.

The payback period method is appealing because it is conceptually straightforward and analyzes the length of time an investment option takes to recover its costs. A shorter payback period is considered superior to a longer payback period. This evaluation method has two primary deficiencies. First, it fails to account for differences in total benefits which occur after the time period when costs have been recovered. Second, it ranks two investments that pay off their costs in the same time period equally, even if a considerably higher percentage of costs are returned significantly earlier in one investment.

The net present value method provides an indication of the value of an investment but it gives no indication of the efficiency of that investment. The primary limitation of this evaluation technique is that it may provide significantly different valuations of an investment depending on the rate of discount that is used.

Unlike the net present value, the benefit-cost ratio method does provide an indication of the efficiency of an investment but does not indicate the net value expected to result from an investment. Like the net present value method, this evaluation technique may produce significantly different results depending on the rate of discount used. In addition, the calculated value depends upon the treatment of negative benefits.

The rate-of-return method improves upon other evaluation criteria because its valuation is independent of the rate of time preference utilized. However, a tradeoff with this evaluation technique is that it is unable to create specific rankings of investment options for different individuals with particular rates of time preference.

In summary, there are numerous tradeoffs in the strengths and weaknesses of the various analytic techniques to relate program costs to benefits. None of the deficiencies is fatal as long as the user has an adequate understanding of the properties of the selected valuation method. Since the appeal of one method versus another is subjective, and because various methods may lead to differing results, it is logical that an evaluator employ multiple evaluation measures in a cost-benefit analysis.

The biases of the analytic approaches discussed in this chapter enter into a cost-benefit evaluation even before the difficulties associated with measuring the costs and benefits of a program are encountered. The measurement problems associated with performing a cost-benefit analysis of vocational education are discussed in the following chapter.

Chapter 5
COST-BENEFIT MEASUREMENT PROBLEMS

OVERVIEW

There are numerous obstacles to measuring the costs and benefits of vocational education. This chapter will identify those problems that might confront a study team performing a national cost-benefit analysis of vocational education and present strategies to overcome them. The conclusions drawn from this chapter are an important component in assessing the feasibility of performing a national study.

The measurement obstacles are discussed in three sections. The first examines general problems that affect the valuation of both costs and benefits. The second section analyzes measurement problems specific to the cost side of a cost-benefit analysis. The final section treats the problems in measuring vocational benefits.

GENERAL MEASUREMENT PROBLEMS

This section concerns general cost-benefit measurement problems. These problems include determining the appropriate measure of student units, controlling for differences in program quality, selecting appropriate comparison groups, over-aggregation in data analysis, calculating an appropriate discount rate, measuring the private and social benefits of vocational education, and adjusting for the limitations in available data sources. Each of these general measurement problems is discussed in the following sections.

Measuring Student Units

The relationship between inputs and outputs in vocational education cost-benefit analysis is typically expressed in per pupil units. Counting the number of students in a school district, in general, and in vocational education programs, in particular, is not as easy a task as it first appears because there are alternative measures of student counts. Selecting among these alternatives requires normative judgment.

The number of students is traditionally measured as either average daily attendance (ADA) or average daily membership (ADM). ADA is computed as the sum of each day's attendance divided by the number of school days in the year. ADM is computed as the sum of school enrollment on each school day divided by the number of school days. ADM is, therefore, larger than ADA.

Both measures of student counts are normatively defensible. Since ADA is a measure of the number of students in actual attendance, it is a truer indication of educational consumption. In addition, ADA is often included in funding formulas because it provides a fiscal incentive for schools to promote regular school attendance. ADM is justifiable because many administrative decisions, such as the number of teachers to be hired and teaching materials to be purchased, must be determined by the maximum potential number of enrollees.

The choice between ADA and ADM as a basis for student counts would be academic if attendance rates were approximately equal in all school districts. This is not the case, however. The characteristics of families that reside in a school district, the environment of the school district's community, and the size of the district are among the diverse factors that affect the level of attendance.[1]

For example, school attendance is usually greater among high income, well-educated families. This may be because these parents recognize the long-term benefits of investing in education and instill these values in their children.

Absences are often higher in urban school districts. This is partially explained by the clustering of low income and poorly educated families in urban areas. In addition, urban districts have a greater proportion of mentally and physically handicapped students who may not be able to attend school regularly.[2] Also, urban school districts are often underfunded (due in part to the greater competition for the tax dollar in heterogeneous communities) relative to their needs (which are disproportionately high due to the high cost of education in cities). As a result, many students in urban districts feel that their educational demands are not being fulfilled and fail to attend classes regularly.

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[1] For a more thorough discussion of these variables, see M.T. Katzman, "Distribution and Production in a Big City Elementary System," Yale Economic Essays 8 (Spring 1968) or M.A. Shugoll, "The Productivity of Educational Revenues: A Concern in the Coming Decade," paper presented at the annual meeting of the American Education Finance Association, New Orleans, LA, 1981.

Attendance rates in large school districts regularly fall below the rates in smaller districts, in part, because large districts tend to be urban. Educators also theorize that large schools are less successful at meeting the academic and guidance needs of individual students.

As the previous examples suggest, the calculation of the size of a school or district may vary based on whether ADA or ADM units are counted. One solution to the ADA versus ADM dilemma is to utilize both measures in the calculation of student units. Some states compute student units as the average of ADA and ADM figures.

Additional student unit measurement problems occur in special programs, such as vocational education, where students may attend programs on a part-time basis. First, there is great variation in what constitutes a vocational education program participant. In some states, any student taking one or more vocational classes is considered a program participant. In other states, the minimum number of classes used to determine a program enrollee is some number greater than one. In still other states, in order to be classified a vocational enrollee, a student must complete a logical progression of related classes designed to meet an occupational objective.

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[2] J.J. Callahan, W.H. Wilken, and M.T. Sillerman, Urban Schools and School Finance Reform: Promise and Reality. (Washington, DC: National Urban Coalition, 1973), p. 14.

Similarly, the methods utilized to measure the level of program participation often produce inaccurate counts. Some states aggregate class enrollments to obtain total program enrollment. This severely overestimates the level of program participation since most students enroll in more than one vocational class (e.g., industrial mathematics, vocational English, and auto mechanics). For example, if a student is currently taking three different vocational classes, he/she may be counted as a program enrollee three times.

Alternatively, overall participation rates are often calculated as the sum of participation in each vocational education program area. Since certain classes may be part of more than one program area, duplicative student counts are again obtained.

The unreliability of vocational education enrollment figures is underscored by the following extreme, but not improbable, example. Assume that the number of vocational students is determined by summing program area enrollments. Further, each program area enrollment is calculated by aggregating class enrollments. If in the example used earlier, three vocational classes are jointly taken by a student and each falls into two different program areas, the same program participant could conceivably be counted six different times in enrollment figures.

One student unit measurement technique that corrects for inflated pupil counts is full-time equivalent (FTE) students. In an FTE system, vocational education program participants are determined by calculating the sum of the proportion of the school year which each student spends in vocational classes. To simplify the calculation, this proportion could be calculated at intermittent periods, rather than every day. For example, Florida calculates FTEs by sampling during one week in the fall and one week in the spring.

The advantages of the FTE measurement method are numerous. First, it minimizes the impact of students enrolled in only one vocational course on overall vocational program enrollment levels. For example, assume that a state calculates FTEs by a one week sampling procedure. In this state, if a student is taking one vocational course that meets daily for one hour, and if the school week is 25 hours long, his/her participation in the program is 5/25 or .2 of an FTE. This is far more realistic than weighting this student equally to a student taking 25 hours a week of vocational instruction.

The FTE methodology also controls for duplicate student counts resulting from calculating vocational curriculum participation by course or by program area. Only the length of time spent in vocational classes is a component of this computation. Therefore, in ordinary cases, each student cannot exceed a value of 1.0 of an FTE.

One additional advantage of the FTE measure over the other measures discussed is that it incorporates information on the duration of and exposure to vocational education. Computations based on simple classroom or program counts ignore the fact that the length and number of meetings may vary for different classes or different types of programs. Without FTE counting, it is probable that classes meeting daily and those meeting biweekly would carry the same weight in total enrollment figures, as would intensive classes running two school periods and those completed in a single period.

However, FTE is not a perfect measure of program participation when performing a cost-benefit analysis. Two limitations are particularly apparent. First, the FTE measure assumes a linear relationship between program participation and resulting benefits. It is possible, though, that as the intensity of vocational training increases, the rate of assimilation also rises. For example, assume that in a 1,000 hour school year, two students respectively take 500 hours (.50 of an FTE) and 250 hours (.25 of an FTE) of vocational classes. The former student may find that his/her greater vocational class load may result in a higher reinforcement of what is learned. Therefore, the benefits accruing to the student receiving 500 hours of vocational training may be more than twice as great as those to the 250 hour-a-year student.

A second limitation of the FTE method is that it is particularly susceptible to sampling bias. This results from its sensitivity to program duration and class exposure. For example, a vocational program may have a "life cycle" which requires the majority of courses to be taken in the first year.

If a student count of program participation is taken for a particular high school class based on second year FTE enrollments, the figure would underestimate actual participation.

These criticisms of the FTE method result exclusively from its sensitivity to duration and exposure. Although this sensitivity presents some measurement limitations, FTE is usually preferable to other student unit calculations which completely disregard duration and exposure.

Differences in Program Quality

In the private sector production process, two firms may manufacture products that are identical except for differences in their quality. In order to properly compare the efficiency (defined as output per unit of input) of these two firms' production processes, the quantity of output must be adjusted to reflect the quality differences. This can be done by weighting each output by its current market price to represent the total value of the output. The contention, although not always reliable in the absence of a perfect market economy, is that higher quality output has a higher market price.[3]

A cost-benefit analysis in vocational education is analogous to an efficiency evaluation of a production process because it relates the level of inputs (costs) to the level of outputs (benefits or outcomes). Just as the quality of similar products may differ in private sector production, so may the quality of outputs of public sector services. For example, one measure of the outputs (benefits) of vocational education is the total number of hours a vocational student spends in class. As Ross and Burkhead suggest, "Certainly those hours differ in terms of what is learned."[4] An hour of instruction in one classroom is not necessarily equal in quality to an hour of instruction in a second classroom. Unlike the private sector, however, direct market prices are not available to adjust for quality differences. Rather, adjustments for quality differences must be made with proxy variables. Examples of proxy variables often used to adjust for differences in the quality of learning during classroom hours are pupil/teacher ratio, teacher experience, and teacher education.

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[3] The reliability of predicting quality from price is discussed in J.E. Triplett, The Theory of Hedonic Quality Measurement and Its Use in Price Indexes (Washington, DC: Bureau of Labor and Statistics, Staff Paper No. 6, 1971).

There are numerous limitations in utilizing proxies to adjust for differences in output quality. First, the justifications for most proxy variables are laden with assumptions. For example, pupil/teacher ratio is utilized as a quality proxy because it indicates the frequency of personal contact between student and educator. The assumption that there is a direct relationship between frequency of contact and school quality is arguable, however. Teacher experience and education are used as proxies because they are thought to measure the quality of teacher-student contact. There are many educators, however, who would contend that experience and education are not determinants of teacher quality.

A second limitation of using proxy variables to control for quality differences is that outputs often have more than one quality dimension. This is true in the example of the number of classroom hours just cited. Therefore, numerous subjective decisions must be made such as whether each proxy should be weighted equally, and if not, how should the weights be determined.

A third problem is that proxies for output quality are often measured as inputs in the production process. For example, as suggested earlier, the quality of education is said to vary with the pupil/teacher ratio, an educational input. Ross and Burkhead doubt the methodological legitimacy of using changes in input quantity as a proxy for changes in the quality of output:

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[4] J.P. Ross and J. Burkhead, Productivity in the Local Government Sector (Lexington, MA: D.C. Heath and Company, 1974), p. 36.

> By adjusting the quality of output with proxies representing changes in the quality or quantity of both inputs and outputs, one is never sure if he has adequately adjusted for all quality changes or if he has merely double-counted.[5]

A final problem is that existing research has had difficulty consistently validating the relationship between quality proxies and educational output. The effects of these variables vary from study to study and even within the same study when multiple measures of output are used. Quality proxy variables found to be significant most often in existing research include: teacher quality measures such as experience, salary, educational degree level, and verbal ability; frequency of teacher contact such as pupil/teacher ratio and the size of the school; quality of school facilities such as the age of the building and the number of books in the library; and expenditure per pupil.[6]

The statistical significance of the latter variable, expenditure per pupil, suggests a potential alternative approach to controlling for differences in output quality. It is theoretically probable that higher quality programs are more costly than those of lesser quality. If this assumption is correct, quality differences are apparently already controlled for on the cost side of a cost-benefit analysis. However, this is only true among school districts that face similar prices for educational goods and services. The cost of hiring good teachers, maintaining school buildings, or acquiring sites for future building construction often varies between school districts. Costs are particularly high in urban districts, for example. An additional factor undermining the previous assumption is that, as in the private sector, the efficiency of the production process is not constant between school districts. Therefore, districts with comparable levels of school revenue may not produce outputs of similar quantity or quality.

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[5] Ross and Burkhead, p. 38.

[6] H.A. Averch, S.J. Carroll, T.S. Donaldson, H.J. Kiesling, and J. Pincus, How Effective is Schooling? A Critical Review of Research (Englewood Cliffs, NJ: Educational Technology Publications, 1974).

In summary, cost-benefit study teams face numerous measurement obstacles related to program quality. First, they must decide whether program quality is an appropriate concern of cost-benefit analysis or whether it is already controlled for in the calculation of program costs. If additional statistical controls are necessary, researchers have to determine whether proxy variables are a satisfactory measurement alternative. Finally, if proxy variables are to be employed, precise operational definitions must be selected from a broad range of possibilities.

Determining Comparison Groups

Most cost-benefit analyses of vocational education fit into one of two categories. The majority compare the efficiency of vocational education to academic or general education. The balance primarily contrasts the returns of alternative vocational programs. An important measurement issue that impacts the results of any cost-benefit analysis is the determination of an appropriate comparison group. The choice of comparison group may alter the assessment of whether or not, and to what degree, vocational education programs are an efficient investment alternative.

A basic consideration is selecting a comparison group similar in academic and social background to that of vocational students. This is necessary because numerous non-educational variables are thought to affect learning potential. As indicated in the state of the art overview chapter, these variables include innate ability (often measured by I.Q. scores), richness of the home environment (measured, for example, by the number of books and magazines in the home), and family background (often measured by parent's income and educational background).

The impact of non-educational variables on student learning results in a serious measurement problem for cost-benefit study teams comparing vocational education to general or academic education. In theory, selecting similar student populations allows the impact of the actual educational training on pupil benefits to be distinguished from uncontrollable environmental variables. In practice, it is often difficult for cost-benefit study teams to match vocational students with students in general or academic curricula on social background variables. This is because these environmental variables are determinants in a student's choice of curriculum. For example, students enrolled in vocational programs tend to score lower on achievement tests and come from families where parents' educational attainment is lower than parents of students enrolled in general or academic programs (although this is becoming somewhat less prevalent).[7] Therefore, researchers must utilize non-experimental methods such as regression analysis to control for non-educational impacts.

A similar issue is selecting a comparison group with comparable cost characteristics. The cost of providing education is not constant across school districts. Different school districts face differing prices for equivalent goods and services due to variant supply factors. As a result, some districts may have to pay more to purchase the same quantities of textbooks, teachers, or property for school sites. For example, if a school is in an isolated area, if working conditions are poor, or if the cost of living in the area is high, districts may have to pay higher salaries to attract good teachers. Differences in cost that are a function of supply conditions and, therefore, are beyond the control of a school district, need to be recognized by cost-benefit analysts. In an analysis of secondary vocational education, this problem can often be resolved by selecting a comparison group from the same school or school district as the vocational class.

There are additional concerns in selecting comparison groups that are unique to the level of vocational education under study. In measuring vocational versus non-vocational program effects on the postsecondary level, a primary issue is whether the appropriate control group is students enrolled in a non-vocational postsecondary program or students who have no formal postsecondary training. This is a critical decision because of the radical differences in the cost term that will be entered in the cost-benefit calculation.

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[7] G. Bottoms, Executive Director of the American Vocational Association, in a statement delivered before the House Subcommittee on Elementary, Secondary, and Vocational Education, September, 1980.

The costs of a postsecondary academic education are considerable while the cost term for students with a terminal high school degree is zero since no additional educational expenditures are incurred.

In the analysis of secondary vocational versus non-vocational education, the choice of an appropriate control group first appears to be between students in a general curriculum (which usually includes non-college bound students) and those in an academic curriculum (which includes college preparatory students). Most research suggests that if the vocational option were not available, the majority of students enrolled in that program would choose the general curriculum option. Therefore, this comparison group is often utilized in existing cost-benefit studies. Since some students would choose the academic curriculum, however, an alternative approach is to measure the sum of the costs and benefits of general and academic curricula weighted in both cases by the proportion of students who choose each option.

A confounding issue in secondary vocational cost-benefit analysis is how to treat high school dropouts. It is probable that if vocational education programs were not available, some students would assess the personal benefits of remaining in school as quite low and choose to drop out. Therefore, a third potential comparison population may be high school dropouts. Many researchers ignore this comparison group in their analyses. A superior methodology is to enter dropouts as a third component, along with general and academic curriculum students, in a weighted average of comparison group costs and benefits.

The introduction of high school dropouts as a comparison group suggests an interesting cost implication. If the provision of vocational training increases the holding power (defined as the inverse of the dropout rate) of a school district, that district must provide education for more students than it would in the absence of vocational education. If this is the case, a calculation of the costs of vocational education should theoretically include the added costs to the school district of training these additional students who, under different circumstances, would no longer be in school. Measuring this added cost is extremely difficult.

A final problem related to dropouts is how to treat leavers of vocational programs in a cost-benefit analysis. A vocational program dropout may have learned enough about an occupational skill or holding a job during his/her limited enrollment to have benefited from the program. It is difficult to resolve how and where these students should be included in an analysis of the costs and benefits of vocational education.

As the previous discussion illustrates, there are numerous measurement problems inherent in cost-benefit methodologies comparing the efficiency of vocational to non-vocational education. Some critics suggest that the methodology of contrasting the returns of vocational and non-vocational education is itself inadequate on an a priori basis. This conclusion is based on the contention that vocational and non-vocational education programs are not merely different means of achieving the same ends. Rather, the two educational approaches serve different populations and are designed to fulfill unique needs. As a result, comparing their benefit-cost ratios may produce misleading results.[8]

Cost-benefit study teams must, therefore, resolve the following dilemma: is it justifiable to compare vocational and non-vocational education or should comparisons be limited to those between alternative vocational programs? One possible compromise solution to this question is to justify the comparison of vocational programs to general or academic programs solely on the grounds of establishing a base of comparison between programs. In other words, the comparison is not intended to contrast the relative efficiencies of the programs but merely to provide a point of reference for an analysis of the returns from vocational education.

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[8] B. Reinhart and H. Blomgren, Cost-Benefit Analysis -- Trade and Technical Education (Final Report). (Los Angeles, CA: University of California, Division of Vocational Education, 1969).

Level of Aggregation

If the results of cost-benefit analyses in vocational education are to be policy relevant, the problem of over-aggregation must be avoided. As indicated during the discussion of the breadth of vocational education in Chapter 2, vocational education has many unique components that must be examined individually. For example, the returns on vocational education are likely to differ by level of study. One should, therefore, not aggregate the impact of secondary, postsecondary, and adult vocational education programs. Similarly, within levels of vocational education, the source of education training may maintain independent effects. The impact of postsecondary vocational training, for example, will differ if the training was received at a community college, a technical institute, a proprietary school, or on the job.

The relationship between program costs and benefits may also vary by student population (e.g., economically disadvantaged, limited English speaking, handicapped), program area (e.g., agriculture, business and office occupations, trade and industrial occupations), and the length of the training process (some programs may entail a three-year series of related courses while others may be just one year in duration). All of the idiosyncrasies in vocational education should be maintained and not disguised through over-aggregation.

Determining Appropriate Discount Rates

A typical consumer prefers immediate income to the same amount of income at some point in the future. In order to induce a consumer to forego income until a future date, a stipend must be offered. Conversely, to equate future levels of income with present values, the future income must be discounted by some amount. A discount rate equates various levels of expenditure and income to a present value.

The discount rate is comprised of two main components. The first is the rate of time preference. This describes a consumer's preference to consume today rather than in the future. The second component is a factor for inflation. This adjusts growth in annual earnings for increases in the level of prices. Use of a discount rate is essential for cost-benefit analysis in order to relate a future stream of benefits to current costs. The determination of an appropriate discount rate is crucial since the magnitude of this rate may significantly alter the outcome of the analysis. In particular, a high rate of discount favors projects where the major benefits accrue in the relatively near future.

The central measurement problem related to discount rates is determining the appropriate level of discount. The market rate of interest is often suggested as an appropriate discount rate. This rate is determined by consumers' (or at least corporations') expectations of inflation and rate of time preference. An alternative measure often proposed is the interest rate on government bonds. This rate has the advantage of reflecting the opportunity cost to the government of spending money on a particular project.

A third alternative is to use an even lower rate of discount to compensate for underestimation biases in benefits measurement resulting from the use of cross-sectional data to forecast future earnings,[9] and, the inability to measure many non-pecuniary benefits. Weisbrod effectively counters this argument for a reduced rate of discount by pointing out that the issues of an appropriate discount rate and biases in cost and benefit estimates are separate issues and should not be confounded.[10] However, downwardly scaled discount rates are often also proposed because the alternatives, the market rate of interest and the rate for government bonds, are accused of being inflated since they are determined by the present generation. Therefore, the preferences of future generations are under-represented, skewing interest rates toward preference for current consumption rather than for consumption by future generations. Market rates of interest are further faulted for being too high because their magnitude, in part, reflects a degree of uncertainty of return. Alternatively, many feel that policymakers should use the same investment criteria (and therefore, interest rate) to evaluate potential investments as private industry.

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[9] H. P. Miller, "Response to Burton A. Weisbrod," Measuring Benefits of Government Investments, R. Dorfman, ed. (Washington, DC: The Brookings Institution, 1965), p. 166.

[10] B. A. Weisbrod, "Preventing High School Dropouts--Concluding Statement," Measuring Benefits of Government Investments. R. Dorfman, ed. (Washington, D.C.: The Brookings Institution, 1965), p. 167.

An additional discount rate measurement problem is that different segments of the population have varying preferences for future income. This is particularly problematic in a cost-benefit analysis of vocational education because young adults (including those age groups who would typically be enrolled in vocational education) may have higher rates of time preference than the general population. This suggests that two rates of discount may be appropriate: one used in the estimation of social costs and benefits, and a higher value used to discount the costs and benefits accruing to the program enrollee.

Private and Social Costs and Benefits

The costs and benefits of vocational education may accrue solely to the consumer of vocational education (private costs and benefits) or they may spill over to society as a whole (social costs and benefits). An example of a private benefit of vocational education is an individual's greater occupational marketability and higher earnings. An example of a social benefit of vocational training is the increased productivity of the workforce.

Cost-benefit analysis may compare social costs and benefits, private costs and benefits, or both. An important measurement issue in cost-benefit analysis of vocational education is determining the proper level of analysis. This choice is significant because there are numerous instances where private and social costs and benefits diverge. For example, assume that a vocational education graduate takes a job for $10,000. Prior to enrolling in the vocational program, this individual received a transfer payment from the federal government (either unemployment compensation or welfare payments) of $4,000 annually. In this case, the private benefit of vocational training is the difference between the individual's current salary ($10,000) and past transfer payments ($4,000), which totals $6,000. However, the social benefit is the private benefit ($6,000) plus the decrease cost to taxpayers of transfer payments ($4,000), for a total of $10,000.

For most Federally subsidized programs, the appropriate sphere of concern in a cost-benefit analysis appears to be the national population. This is because all taxpayers contribute to the funding of the program. Accordingly, social costs and social benefits are generally the level of comparison. In some Federally subsidized programs, such as vocational education, each individual decides whether to consume the service. (In services that are pure public goods such as defense, no individual consumption choice is made.) In programs with consumer discretion, the private benefits resulting to an individual must exceed private costs to induce that individual to participate in a program. Therefore, in a cost-benefit evaluation of vocational education, calculation of both private and social costs and benefits appears to be appropriate.

The potential divergence between social benefits and costs and private benefits and costs has considerable implications for the investment of dollars in vocational education. In situations where the social benefits of a program exceed social costs, but the private benefits of program enrollees are less than private costs, a government agency has incentives to increase the size of private benefits relative to private costs. For example, if a special program yielded a positive net social benefit of $100 per program participant, then the sponsoring agency would have an incentive to pay program participants up to $100 to participate in the program.

Quantification of the spillovers resulting from vocational education is extremely difficult, although this does not make their impact on social welfare any less real. However, as Stromsdorfer suggests, the inclusion of certain intangible benefits of vocational education in a cost-benefit analysis, such as increased mobility or labor force discipline, may be redundant since these are most probably already reflected in the economic benefits of higher wages.[11]

An interesting caveat to the measurement problems of costs and benefits arises from the examination of private costs and benefits of vocational education. For a rational person to enroll in a vocational program, this person must perceive that the private benefits exceed the private costs. In a situation where a cost-benefit analysis estimates that the private costs exceed the private benefits, and yet students remain enrolled in the program, the estimated difference between private costs and benefits may be at least a partial indicator that there are significant non-measurable benefits accruing to the program enrollee. This caveat may also be extended to other actors in the vocational education governance structure (e.g., individual schools, local school systems, local communities, the state vocational education agency) who presumably support vocational education based on the assumption that the benefits achieved exceed their costs.

Limitations in Vocational Education Data Sources

Numerous sources of vocational education data are available. These sources vary in quality, comprehensiveness, and timeliness. Among those that could be used in a cost-benefit analysis of vocational education are the:

- National Center for Education Statistics' (NCES) Vocational Education Data System (VEDS)
- Bureau of Occupational and Adult Education's (BOAE) Statistical Reports (1973-1978)
- NCES' High School and Beyond Longitudinal Survey (1980)
- Department of Labor's (DOL) National Longitudinal Survey (1979)

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[11] E.W. Stromsdorfer, "Economic Concepts and Criteria for Investment in Vocational Education," Occupational Education--Planning and Programming. Volume Two. A. Kotz, ed. (Menlo Park, CA: Stanford Research Institute, 1967).

- NCES' National Longitudinal Survey of the High School Class of 1972
- National Institute of Education's (NIE) Survey of Vocational Schools in Ten States (1980)
- NCES' Survey of Non-collegiate Postsecondary Students and Schools (1972-1980)
- Assistant Secretary for Planning and Evaluation's (ASPE) Survey of Vocational Education Students and Teachers (1972)
- Office of Civil Rights' (OCR) Survey of Vocational Education Schools (1979)
- Office of Education's (OE) "437 Files" (Grants and Expenditures under State Administered Programs)
- Census Bureau's Current Population Survey Supplement
- Project Talent Data Base
- NCES' Survey of Course Offerings and Enrollments (1973)
- Survey Research Center's Youth in Transition Data Base (1966).

These individual data bases, with one exception, are not reviewed in this report since such an evaluation was recently conducted by the U.S. Office of Education, Office of the Assistant Secretary for Planning and Evaluation (ASPE).[12] The exception is VEDS on which a brief discussion is included since it was recently introduced as a resource that will overcome many past reporting inaccuracies.

The focus of this section is on identifying the problems that commonly plague vocational education data collection mechanisms, and consequently, vocational education data bases. These data deficiencies are so severe that ASPE concluded in its general review of vocational education data collection resources that "Current official statistics are, at best inaccurate; at worst they are deceptive."[13]

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[12] L. Brown, R. Barnes, M. Currence, and D. Henderson, Research and Data Resources in Vocational Education: An Assessment (Washington, DC: U.S. Office of Education, Office of the Assistant Secretary for Planning and Evaluation, 1980).

General Limitations

There are many limitations that generally plague vocational education data bases. First, much of the data is cross-sectional without follow-up information. This is a problem for a cost-benefit study team because most vocational programs are multi-year with different levels of exposure and duration throughout the training process. Therefore, data collected on a vocational education program at one point in time may misrepresent the overall program. The actual effectiveness of multi-year programs can only be determined with longitudinal data covering the life-cycle of a program.

Cross-sectional data that excludes follow-up information also present difficulties in measuring the returns over time to vocational education. This issue is important since the benefits of vocational training, particularly in terms of personal income, are not necessarily constant. Some data bases do maintain information on vocational students for one or two years after graduation. However, even this limited longitudinal data may be deficient in accurately assessing the effectiveness of vocational education. For example, if the greater benefits of vocational education compared to general or academic education are equalized after the first few years, data bases limited to two year follow-ups will not capture this effect.

A second concern with vocational education data is the source of the data. Data on enrollment and curricula are usually provided to cost-benefit study teams by school administrators or a survey of school records. Information on employment is often provided by the students. Each of these three sources of data contains biases of which researchers must be aware. Very often data inconsistencies are a result of the varying primary sources of vocational data.

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[13] Brown, Barnes, Currence, and Henderson, p. 32.

A third data problem is changes over time in standard vocational definitions. As record keeping becomes more precise and deficiencies in previous definitional processes are corrected, comparisons of annual data may become misleading. Definitional changes are most obvious in the area of program enrollment. Some of the reported increase in vocational program participation is attributable to such changes in definition.

Fourth, data are often collected only within the seven broad occupational areas described earlier. As a result, data may be available on agriculture and trade and industrial occupations. However, very little information may exist on individual training programs such as farm mechanics. The effectiveness of specific training programs within occupational areas is likely to vary. Nevertheless, the extent of the variance often cannot be determined due to the predominance of data aggregated by occupational area.

State and Sub-State Data

Education has traditionally been a shared local and state responsibility. As a result of this decentralization, great disparities in vocational education data availability, quality, and level of computerization exist both between and within states. Data incompatibility is, therefore, a potentially critical problem to cost-benefit evaluators of vocational education.

The types of data available in local education agencies (LEAs) and state education agencies (SEAs) differ sharply. For example, some LEAs and SEAs maintain comprehensive placement records by student characteristic (e.g., sex, race, ethnicity, handicapped, disadvantaged). Others maintain summary placement data that cannot be disaggregated by pupil type. Still others have no placement data on file.

Cost-benefit study teams must also overcome inconsistencies in data quality and reliability. Data quality is in part determined by the timeliness and thoroughness of information files. The quality of data suffers in some states, for example, because information is collected from a sample of school districts and then projected for the balance of the state. This approach diminishes data quality because of the idiosyncrasies in many vocational programs, such as differences in program duration and exposure.

The level of automated record keeping varies distinctly on an inter-state and intra-state basis. Many LEAs and SEAs still rely almost entirely on manual data files. Disparities in the level of computerization are important since an automated system increases the sophistication and speed with which an agency can analyze program impacts, and, of more relevance to a cost-benefit study team, facilitates the efficient tracking of a student through the educational process and into the job market. Districts utilizing manual files have difficulty tracking individual students and very often only have data readily accessible for the current school year.

Decentralization of the educational process has also led to variations in data definitions. As described earlier, this is a particular problem for cost-benefit research in terms of enrollment figures. For example, some LEAs and SEAs are more successful than others in distinguishing between program participants and class enrollees. Recording adult vocational enrollments is a second example of inter-state and intra-state definitional disparities. Some states or school districts regard all adult vocational education students as postsecondary participants. In others, an adult taking an evening vocational course in a high school is categorized as a secondary student.

Federal Data Sources

The fragmented process of data collection and record keeping plays havoc on Federal attempts to centralize information on vocational education. The utility of many Federal data bases is severely undermined by the inter- and intra-state variations in data availability, quality, and definitions. Inconsistencies on the state and sub-state level are magnified into serious incompatibilities at the national level.

Although much of the deficiency in Federal data bases may be traced to their sources, some potentially problematic reporting practices by the federal government must also be discussed. First, the Federal Government invariably asks the states for some data types that are unavailable. Second, many states and school districts are forced to report to the Federal Government from files that were not designed for that purpose. A result of both of these factors is that much guesswork on the part of states and school districts is necessary to comply with Federal reporting requirements. This further diminishes the utility of Federal data sources. In addition, many school districts feel that the constant Federal requests for data, on top of already complicated state reporting requirements, are bothersome, repetitive, and uncalled for. Therefore, numerous districts do not take the time necessary for accurate reporting. A third problem is that, despite the two preceding state reporting deficiencies and other widely acknowledged state data limitations, the Federal Government accepts almost all state data as reported and without challenge. Thus, there is a serious question of quality control in Federal level data bases and major a priori limitations to using these data in cost-benefit analyses.

A new data resource which was designed to overcome many of the preceding problems is VEDS. All states are required to submit VEDS reporting forms. VEDS was introduced in a scaled-down version in 1978-79. 1979-80 represented the first year of complete reporting. The Government is currently working to make the 1979-80 data available to the public.

VEDS collects information on five principal areas:

- program enrollment and completion
- number of people completing or leaving vocational programs
- assessments by employers of the technical expertise of program graduates
- teacher/staffing reports
- financial reports

Despite the obvious contribution of providing timely annual data on vocational education, it has become apparent that VEDS does not successfully overcome the deficiencies of prior reporting efforts. First, many states do not believe there is a need for these data and feel that the system has been forced upon them by the Federal Government. Second, despite lengthy pages of reporting definitions and standards, there is still no standard definition of a program participant. Further, states are left to their own discretion on how to collect enrollment data. Some states collect information from a sample of LEAs and make projections for the balance of the state. Thus, there are extreme comparability problems across states on enrollment figures. Fourth, there are no data on program exposure or duration. Fifth, the Federal Government has provided inadequate funding and staffing to oversee the reporting process and institute quality control procedures. Sixth, the implementation of VEDS came at the expense of much political compromise which reduced, and in some cases completely eliminated, many of the innovative aspects of the system.

The use of VEDS data, perhaps supplemented with some additional primary data collection, should be considered in a national cost-benefit analysis of vocational education primarily because of their timeliness. However, as the preceding discussion indicates, these data are subject to most of the same data limitations that generally plague existing vocational education information.

PROBLEMS IN MEASURING VOCATIONAL EDUCATION COSTS

The accurate measurement of vocational education costs provides numerous obstacles to potential cost-benefit study teams. The measurement problems in cost-benefit analysis specific to the cost side are discussed in this section. These problems include the calculation of joint costs, capital costs, and opportunity costs.

Joint Costs

Many costs in providing a vocational education program would not be incurred by a school district if it provided only general and academic curricula. One example of these program specific costs is the cost of purchasing vocational training equipment and machinery. These added costs must be computed in a cost-benefit analysis of vocational education.

There are other costs, however, that are basic to an educational facility regardless of the curricula offered. Examples include construction of an auditorium, provision of a school lunch program, and installation of student lockers. These costs are called joint costs because they are commonly shared by more than one school population (for example, vocational and non-vocational students). A second type of joint cost occurs when a facility or input is used by successive student cohort groups. Most pieces of instructional equipment have a life-span of many years and, therefore, are used by students of numerous graduating classes.

It is difficult to allocate accurately the share of a joint cost that should be borne by various student populations or successive student cohort groups. In the case of multiple usage by different populations, the traditional method of allocating joint costs is to prorate total costs based on some common denominator. For example, joint costs may be allocated on the basis of the proportion of total school space used by each student population or a group's proportion of the overall school population. For the case of successive student cohorts, joint costs are often allocated by imputing an annual rental value for a facility or a piece of equipment. The calculation of this rental value is discussed in the following sub-section, "Capital Costs." Both of these methods make numerous assumptions and have serious flaws. In fact, economists and vocational educators have few satisfactory methods for coping with joint costs. Cost-benefit analysts may obtain guidance from game theorists who have made some progress in partialing out the components of joint costs.

Hu and Stromsdorfer suggest that joint costs are not a measurement problem if a school is operating at less than capacity. Under such conditions, the use of a common facility by one student does not reduce the ability of another student to use the same facility. Therefore, the marginal cost of using the facility is zero. Hu and Stromsdorfer write:

> Because efficient investment decisions between two (or more) alternatives are made on the basis of marginal costs, joint costs present no basic problem to cost-benefit analysis.[14]

Hu and Stromsdorfer's argument is apparently based on either one of two premises. First, one might assume that the facilities or equipment that result in many of the joint costs in a school were purchased with a large capital investment at one point in time. In other words, they are sunk costs. Therefore, the marginal cost of utilizing the facility or equipment for each student, after the initial student user, is zero (up until the capacity of the facility or machine is reached).

Alternatively, one might suggest that the initial cost of a facility or machine should be allocated over time. In this case, it is still possible to eliminate the potential problem of joint costs by attributing the costs solely to the student population that is the primary user of the facility or equipment. This approach may be justified because the marginal cost of additional useage by a secondary student population is zero (up until the capacity of the facility or machine is reached).

Two assumptions are arguable in Hu and Stromsdorfer's presentation. First, are the marginal costs of using a common school facility equal to zero? Second, is the use of marginal cost in cost-benefit analysis appropriate? The first of these issues is discussed below while the latter issue is treated in the following sub-section concerning capital costs.

Hu and Stromsdorfer's judgment that the marginal cost of using a common facility, such as an auditorium or cafeteria, is effectively zero is accurate if the facilities are used at less than capacity. However, many other educational inputs that are used by both vocational and non-vocational students are in limited supply. Generally, the fact that vocational students are using an educational input precludes someone else from using it. The most obvious example of this is the case of a vocational education student using a piece of machinery such as a lathe. No other student may use that lathe at the same time and, therefore, the marginal cost of use of that lathe by the vocational student is not equal to zero. True, the marginal cost of a short wait to use a lathe appears small, but for school districts facing increasing demand for vocational classes, the marginal cost of new machinery and shop facilities may be very large. Therefore, joint costs may present a basic problem to cost-benefit analysis. This problem must be addressed by cost-benefit study teams.

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[14] T. Hu and E. W. Stromsdorfer, "Cost-Benefit Analysis of Vocational Education," Handbook of Vocational Education, T. Abramson, C.K. Title, and L. Cohen, eds. (Beverly Hills, CA: Sage Publications, 1979), p. 200.

Capital Costs

Capital costs are the most obvious example of joint costs. This is because the capital equipment of a school may be used by numerous generations of vocational and general education students. Two approaches are generally used to allocate capital costs: marginal cost and average cost methods.

Marginal cost is the addition to total cost of a unit increase in output. An example of marginal costs might be the additional costs incurred in providing classroom space for one additional vocational student. Average cost equals total cost divided by the number of units produced or consumed. In the case of a piece of equipment, average cost would be calculated as the total cost of the equipment divided by the number of students who use the equipment.

Use of the marginal cost method to allocate capital costs is often preferred to the average cost method since it leads to efficient use of inputs. For example, in situations where a facility or input is being used at less than capacity, the marginal costs of additional students using that facility or input may be close to zero. If a school has a shop classroom that is being used only two periods each day, for instance, the marginal cost of use of the classroom by additional students during other periods in the day is effectively zero (excluding, of course, increases in costs directly attributable to the additional usage such as electricity, maintenance or clean-up). In this case, increased utilization leads to more efficient use of capital

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equipment since the ratio of the number of users to equipment costs increases. As long as the benefits resulting from an additional student who attends a vocational class are more than the additional costs of providing that student with instruction, efficiency can be increased and enrollment in the class should be encouraged.

Several criticisms of the use of marginal costing in cost-benefit analysis exist, however. These criticisms are also applicable to the Hu and Stromsdorfer treatment of joint costs presented in the previous sub-section. First, an evaluation of marginal cost in some ways is very subjective. For example, if one accepts the validity of treating joint costs by attributing them solely to the primary user group (in itself a subjective judgement), a normative decision must be made in determining who is the primary user. This decision is important in a cost-benefit analysis of vocational versus non-vocational education because it will determine whether these costs are included in the vocational students' or the general or academic students' cost function. This normative decision may seriously impact the findings of such a study.

A second criticism is that marginal cost methods might favor many small vocational programs as adjuncts to conventional programs, rather than a consolidated, separate vocational school which may enjoy economies of scale. That is, if vocational students are assumed to be the consumers of the excess capacity of schools and school facilities (in other words, the secondary users), marginal cost methods would suggest that the costs of providing vocational education as an adjunct to non-vocational programs is less than creating a separate vocational facility. However, this calculation may misrepresent the optimal distribution of school dollars because it ignores the potential economies of scale of having most or all vocational students in a single school.

Third, the marginal cost function of a physical asset is extremely variable. For example, assume that a piece of capital equipment may be efficiently used by up to 30 people. The marginal cost of use of that equipment by the second through thirtieth student is very low. However, the marginal cost of use of the equipment by the thirty-first (as well as the first) student is very high since it implies the purchase of a new piece of equipment.

A final limitation of the marginal cost method is that it does not reveal expected costs. Since cost-benefit analysis is seldom performed to calculate the benefits and costs of teaching a specific student, some measure of expected cost per pupil should be calculated. For all of the preceding reasons, the average cost method for allocating capital costs is often utilized in cost-benefit analysis.

Once an appropriate method of allocating capital costs per student unit has been decided upon, some measure of the cost of using capital equipment must be selected. The most obvious measure is the original cost of the capital equipment, including interest payments. However, this may tend to understate the present costs of using a facility or machine since inflation has distorted the original cost. Alternatively, replacement costs could be used, but this tends to overstate the cost of the current use of the facilities since actual replacement is not necessary. Perhaps the true market value of school space would be the most appropriate measure of the capital costs of school facilities. Since no large market for the long term leasing of school facilities currently exists, however, this value would be difficult to determine.

Opportunity Costs

Opportunity costs measure the value of using an activity's inputs for some alternative purpose. In a cost evaluation of vocational education, opportunity costs enter most prominently as the potential alternative value of the time a vocational student spends in class. This value is usually estimated by the amount of income a student would have earned had he/she been working rather than attending class (foregone income).

There are numerous methods to calculate foregone income. Since many vocational students also have part-time jobs, one technique is to project the student's potential full-time annual earnings based on his/her part-time income. Such extrapolation is likely to result in biases, however, since the hourly wage of students working part-time may be lower than the wage they would receive in a full-time position.

An alternative proxy for the foregone income of vocational students is the average earning power of individuals with similar academic and socioeconomic backgrounds who have not elected to continue their education but are working. This approach also has serious biases. First, it is extremely difficult to match students and non-students on their backgrounds. As is the case with selection of types of curricula, which was discussed earlier in this chapter under the heading "Determining Comparison Groups," social variables tend to be a determinant of whether an individual stays in school or drops out in order to work. Second, this figure will overestimate actual earning potential since some students enrolled in vocational programs would be unable to find jobs. Therefore, this measure of foregone income should be discounted based on the percentage of non-students in the comparison group who are currently unemployed.

PROBLEMS IN MEASURING VOCATIONAL EDUCATION BENEFITS

Accurate measurement of the benefits of vocational education is an extremely demanding task. The problems of measuring vocational benefits are discussed in the following sections. These difficulties include measuring the investment and consumption components of vocational education, determining unbiased estimates of income differentials, conceptualizing the impact of an earnings multiplier effect, and operationalizing non-pecuniary benefits.

Educational Investment Versus Consumption

Education is a service that has both investment and consumption components. Part of the education process is viewed as investment-oriented because the student is investing in "human capital" with the anticipation of resulting future increases in income. The remaining part is considered consumption since the student consumes the educational process purely for immediate personal gratification. This distinction results in a measurement problem in cost-benefit analysis because the consumption component of education is not directly measurable. As a result, the total returns of education are measurable only in part, and therefore, generally underestimated.

This may be a particular problem in vocational education cost-benefit analyses comparing vocational to non-vocational programs if, as Carroll and Ihnen suggest, vocational education is more investment oriented than general or academic education.[15] They assume that a higher percentage of course work in vocational education is occupationally related. The measurement consequence of this assumption is that the returns from general or academic education are even further underestimated in relation to vocational education. Thus, the overall comparison of costs and benefits for vocational versus general and academic education may not be comparable, since a higher proportion of the monetary benefits of the latter are unmeasurable.

Carroll and Ihnen also recognize a counterbalancing argument. Since vocational training is very specialized, a vocational student's marketability is perhaps less adaptable than that of a general or academic education student in regard to changes in market demand conditions. When this factor of job obsolescence is introduced, the proportion of vocational education that is typically considered investment oriented should be decreased. Although, in theory, this somewhat offsets the proportional differences in the investment component of general and academic versus vocational education, the impact of job obsolescence is not easily measured.

Another consumption/investment measurement problem is how to treat non-occupational vocational students such as enrollees in special programs like consumer homemaking. In many cases, these students are enrolled purely for consumption purposes. Since consumption oriented benefits are so hard to measure, it is difficult to calculate the rate of return from these programs. Similarly, enrollees in single vocational courses (as distinguished from vocational programs) and many adult education courses are concerned only with personal consumption benefits.

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[15] A. B. Carroll and L. A. Ihnen, "Costs and Returns for Two Years of Postsecondary Technical Schooling: A Pilot Study," Journal of Political Economy 75 (1967), p. 862.

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A complicating factor in the preceding discussion is that although a student may take vocational classes or enroll in a vocational program for personal consumption, that action may produce monetary benefits. For example, assume a student takes a woodworking class because he/she enjoys the subject. If at some point this student builds a piece of furniture, the total cost of the furniture likely will be less than if it was purchased in a store. This is an often overlooked monetary (investment) benefit to a student enrolling in vocational education purely for personal satisfaction (consumption) reasons.

Income Measures

One of the principal benefits generally associated with vocational education is increased earning capability which is typically measured by comparing the incomes of a group of vocational graduates with those of a comparison group. As mentioned previously, one measurement problem for cost-benefit evaluations is that the degree of comparability between two groups may substantially influence the results. Since random selection is almost always infeasible in cost-benefit analysis, comparison of income levels for vocational and non-vocational education students may be subject to significant biases resulting from income determining factors other than education.

In order to eliminate these biases, many cost-benefit evaluators use regression analysis to estimate the effect of vocational participation on income. Regression analysis is a useful technique as long as its limitations are recognized. One limitation is that it provides information concerning correlation but not causation. Also, technical problems such as multicollinearity between independent variables may distort variable coefficients. Nonetheless, this approach is a viable mechanism to estimate vocational education's effect on students' income.

Among the additional income measurement problems faced by cost-benefit analysts is choosing between numerous potential measures of earning capability. An appropriate measure of increased earnings should account for income earned through labor rather than investments (unless investing was a subject in a vocational class). In this sense, earnings rather than income is a more appropriate measure of benefits resulting from vocational education. Earnings is also a superior measure to wage rates. This is because wage rates do not account for differences among workers in the probabilty of being unemployed. For example, a worker may have a high wage rate but the work may be seasonal and he/she may face long periods of unemployment. In this case, annual earnings is a more realistic measure of earning capability.

Forecasting earnings differentials into the future is an additional problem for cost-benefit analysis. For example, available longitudinal data may not cover a long enough period to reflect closure between the incomes of vocational students and the respective control group. Ironically, the longer the time period of the available data, the less relevant the information is to present-day vocational programs. This is because, to the extent that vocational education has changed during that time period, the information is relevant solely from a historical viewpoint. For example, longitudinal data which cover a ten year period provide information on the effects of a vocational program that is at least ten years old. Similarly, the income differentials extrapolated from cross-sectional data are indicative of past vocational programs. The biases resulting from these deficiencies are not fatal to a cost-benefit analysis, but an evaluator should be aware of their implications.

Another difficulty in determining the income benefits resulting from vocational education is that the widespread growth in vocational education participation has likely shifted the supply curve of skilled labor. Continued increases in vocational enrollment could radically alter the equilibrium supply and demand conditions for skilled labor. A similar circumstance occurred with college education. Sharply increased enrollments in postsecondary education programs are often credited with altering the supply conditions of college educated job seekers. This sharp increase in the supply of college graduates reduced their value in the demand market, thereby decreasing the measured rate of return resulting from a college education.

An issue closely related to income measurement is the measurement of fringe benefits. Fringe benefits, e.g., health insurance, vacation time, etc., are becoming an increasingly important portion of most employment packages. The measurement problem here is primarily a lack of data. If data on fringe benefits were readily accessible, such factors as the dollar value of an employer-offered health policy and the wage earned during vacations with pay could be utilized in calculating the total value of a benefits package.

Earnings Multiplier Effect

The real increase in a person's income has economic effects greater than the net change in income experienced by the worker. With a real increase in disposable income, a consumer will typically spend a large portion of that increase. The income that is spent increases the income of another consumer who continues the chain. This chain does not continue indefinitely, however, as leakage exists in the form of savings.[16] Nonetheless, this multiplier effect can be substantial. Therefore, examination solely of income increases severely understates the full effects of vocational education on national income. However, it is extremely difficult to operationalize the impact of an earnings multiplier effect.

Non-Pecuniary Benefits

The major criticism of cost-benefit analysis regards the exclusion of non-pecuniary benefits from the cost-benefit calculation. These benefits are often excluded because no generally accepted mechanism for quantifying them currently exists. Many feel that without inclusion of non-pecuniary benefits the value of cost-benefit analysis is diminished because the non-measurable benefits resulting from vocational education dwarf the measurable benefits. Non-pecuniary benefits which are generally assumed to result from vocational education include: greater opportunities, contentment with one's educational training, higher job satisfaction, positive work attitude, employers' satisfaction with employee performance, permanence of one's job, lower likelihood of committing crimes, better citizenship, and a greater sense of well-being.

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[16] Increased savings also create a positive effect on national income, but in a smaller and more indirect manner.

Most non-pecuniary benefits are measurable to a degree. However, quantifying these benefits into monetary values is at best subjective. For example, how does one measure the personal benefit of job satisfaction in monetary terms? Because of this difficulty, cost-effectiveness analysis has gained favor since it does not require quantification of non-monetary benefits. Cost-effectiveness analysis evaluates the most cost-effective means to obtain a given set of goals. The trade-off in using cost-effectiveness analysis is that even if a program is the most cost-effective of a set of programs, no absolute statement of its monetary value may be inferred. Also, cost-effectiveness must rely on a subjective scale of measurement and set of goals, and subjectivity over the relative importance of each goal.

The inability to measure non-pecuniary benefits is particularly damaging in using cost-benefit analysis to evaluate government policies and programs. This is because vocational education may play an important role in reducing poverty, redistributing income, increasing inter-generational mobility, and reducing prejudice. Although the value of these variables is not exactly known, the billions of dollars the U.S. government has spent in these areas is indicative of their importance.

Proponents of cost-benefit analysis would tend to agree that exclusion of non-monetary benefits is a serious, but not fatal deficiency. Cost-benefit analysis is effective in comparing the measurable costs and benefits of programs and policies. Such an evaluation provides a useful foundation for analyses of the relative magnitudes of a program's non-measurable benefits and costs.

Cardus, Fuhrer, and Thrall provide a methodology for incorporating non-pecuniary benefits and costs into a cost-benefit framework.[17] They propose a multi-dimensional model measuring groupings of costs and benefits along unique dimensions. The methodology relies on successive subjective evaluations by a group of evaluators to arrive at a qualitative valuation of total non-monetary benefits. The different benefit and cost dimensions are then summed as a function of a set of parameters determined by the policy maker.

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[17] D. Cardus, M. J. Fuhrer, and R. M. Thrall.

CHAPTER 6
A COST-BENEFIT MODEL OF VOCATIONAL EDUCATION

INTRODUCTION

A model specifies the variables that make up a functional system and the interrelationships between these variables. In order to assess the feasibility of performing a national cost-benefit study of vocational education, a preliminary investigation of the potential components of the model must be undertaken. This is because the feasibility of conducting a national study depends upon the variables that make up the model, the ability to operationalize these variables, and the availability of data to implement the model. This chapter discusses the process of constructing a cost-benefit model, presents a preliminary specification of a vocational education cost-benefit model, and reports the results of the Delphi analysis that evaluated the model specification.

Following the introduction, the chapter is divided into six sections. The first section considers the utility of a cost-benefit model and proposes a general modeling format. The following section prescribes a strategy for developing a cost-benefit model that is consistent with the previously cited format. The third employs the modeling format and strategy to produce a very preliminary specification of a cost-benefit model of vocational education. The fourth section explains the general characteristics of Delphi analysis. This is followed by a description of the methodology employed to implement a Delphi analysis as a means of evaluating the model specifications. The chapter concludes with a summary of the results of the Delphi analysis.

UTILITY OF A COST-BENEFIT MODEL

The utility of a well-designed model is multi-fold. First, because model building is an information generation and problem identification process, it can illuminate a comprehensive range of policy options. A policy decision that consideres the issues raised in the modeling process may be made with more complete information than in other circumstances. Second, by specifying the particular factors in a functional system, the modeling process signals the type of technical expertise needed in the decision-making process. Consultation with the proper technical experts can contribute to a more educated policy decision. Third, since revenues are not infinite, policy makers must choose among alternative programs to allocate limited funds. It is quite rational to base such decisions, in part, on the relationship between program costs and benefits. Careful modeling can specify this relationship which then can be quantified using various cost-benefit analytical techniques. Fourth, the presence of a model can defend a decision maker against criticism. Policies are often evaluated based on the success of an outcome rather than the soundness of a decision. Many sound decisions with the potential for positive outcomes produce less than anticipated results due to intervening variables and stochastic events. Regardless of the outcome, few can argue with the wisdom of a decision based on weighing the expected advantages and disadvantages before undertaking a course of action.

Cost-benefit modeling (as well as subsequent cost-benefit analysis) is not a substitute for managerial judgment. Rather, it is a contributing factor to making sound management decisions. Cost-benefit modeling (and analysis) can help increase the information available to a policy maker which results in decisions superior to those based solely on subjective judgment.

FORMAT OF A COST-BENEFIT MODEL

This section discusses the interrelationships among the components of a cost-benefit model. These components are:

- Theoretical sub-models
- Theoretically complete global model
- Operational global model
- Operational sub-models

These interrelationships are displayed graphically in Figure 6.1. This figure also illustrates the diversity of potential operational sub-models in any cost-benefit analysis.

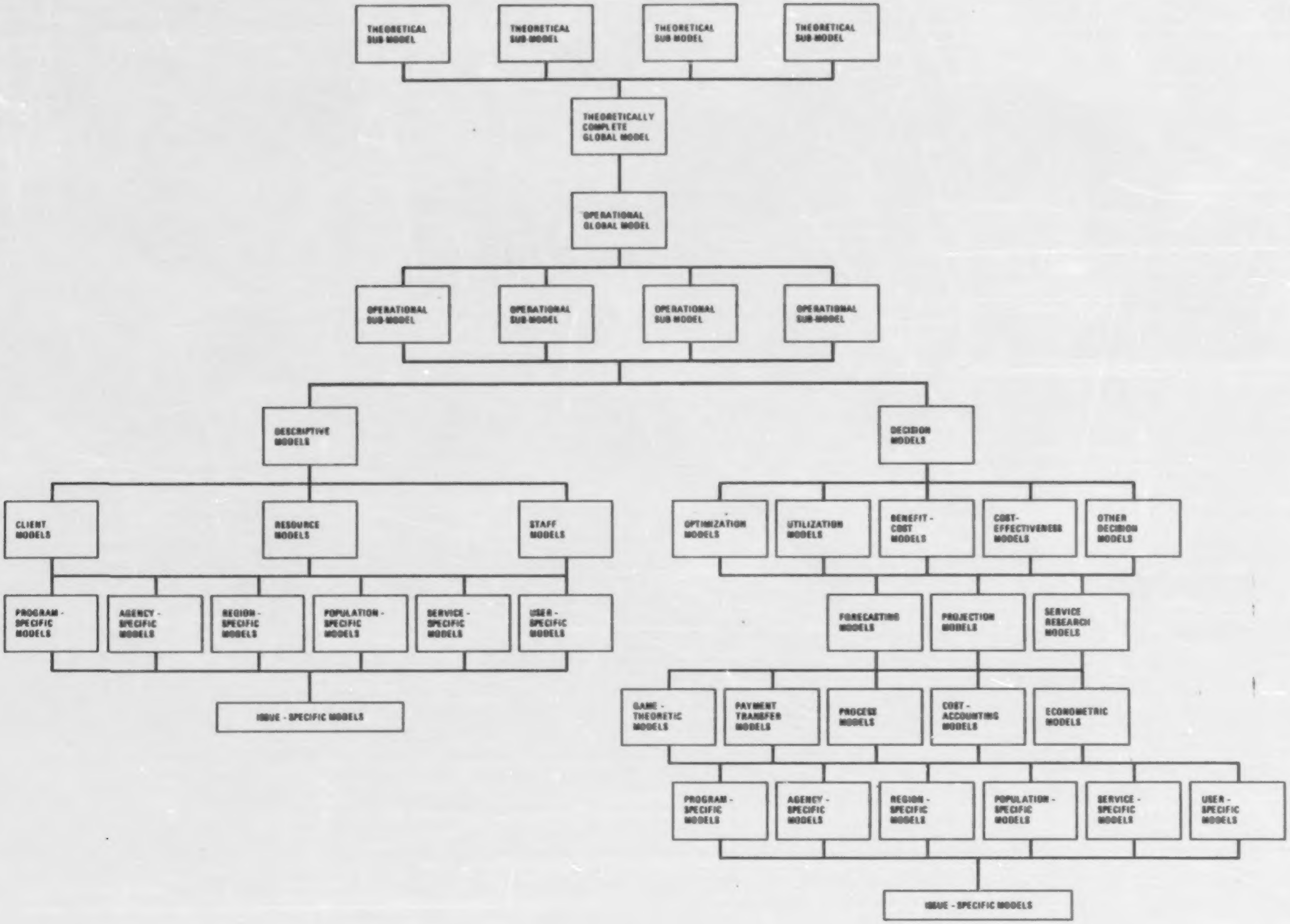
THEORETICAL SUB MODEL
THEORETICAL SUB MODEL
THEORETICAL SUB MODEL
THEORETICAL SUB MODEL
THEORETICALLY COMPLETE GLOBAL MODEL
OPERATIONAL GLOBAL MODEL
OPERATIONAL SUB-MODEL
OPERATIONAL SUB-MODEL
OPERATIONAL SUB MODEL
OPERATIONAL SUB-MODEL
DESCRIPTIVE MODELS
DECISION MODELS
CLIENT MODELS
RESOURCE MODELS
STAFF MODELS
OPTIMIZATION MODELS
UTILIZATION MODELS
BENEFIT - COST MODELS
COST-EFFECTIVENESS MODELS
OTHER DECISION MODELS
PROGRAM - SPECIFIC MODELS
AGENCY - SPECIFIC MODELS
REGION - SPECIFIC MODELS
POPULATION - SPECIFIC MODELS
SERVICE - SPECIFIC MODELS
USER - SPECIFIC MODELS
FORECASTING MODELS
PROJECTION MODELS
SERVICE RESEARCH MODELS
ISSUE - SPECIFIC MODELS
GAME - THEORETIC MODELS
PAYMENT TRANSFER MODELS
PROCESS MODELS
COST - ACCOUNTING MODELS
ECONOMETRIC MODELS
PROGRAM - SPECIFIC MODELS
AGENCY - SPECIFIC MODELS
REGION - SPECIFIC MODELS
POPULATION - SPECIFIC MODELS
SERVICE - SPECIFIC MODELS
USER - SPECIFIC MODELS
ISSUE - SPECIFIC MODELS

Figure 6.1. Interrelationships Between the Theoretical Sub-Models, Theoretically Complete Global Model, Operational Global Model, and Operational Sub-Models.

The format proposed for constructing a cost-benefit model of vocational education is influenced by the breadth of the vocational education enterprise. Vocational education delivers services on secondary, postsecondary, and adult levels; offers over 400 course types in seven occupational program areas; provides technical instruction in a variety of institutional settings; and teaches diverse student populations with varying educational needs. Because of this breadth, it is impossible to create one simple model to evaluate the costs and benefits of the entire realm of vocational education. Rather, a series of theoretical sub-models with unique components must be designed.

When the universe of theoretical sub-models is specified and logically interrelated, a theoretically complete global model exists. The theoretically complete global model reflects all the factors in the vocational education system regardless of the ability to measure or interpret them. It also characterizes the relationship between vocational education and the environment in which it operates.

It is probable that some of the specified variables in a theoretically complete global model cannot be measured and/or some of the interrelationships cannot be operationalized. This may be due to the unavailability of data or simply to the lack of accurate measurement tools. In such instances, it is necessary to simplify the model by creating an operational global model. This model includes all factors of the functional system that can be measured and interpreted. Therefore, the operational global model trades off the thoroughness of the theoretically complete global model in favor of practicality. It is the operational global model, rather than the theoretically complete global model, that is the basis for executing a cost-benefit analysis.

The operational global model is actually an aggregation of operational sub-models. Very often one or more of the sub-models is implemented in a cost-benefit analysis rather than the operational global model. Which of the sub-models are employed may depend upon what is the particular research question, how the results will be utilized, and/or who is the potential user of the information resulting from the analysis.

Very often, the guidelines of a cost-benefit research project are so broad that they are almost global. Nevertheless, limited resources may force a study team working on such a project to choose among the various sub-models rather than implementing the operational global model. In such cases, the universe of operational sub-models may be prioritized based on the needs of the sponsoring agency, the desires of those in the field who will use the results of the analysis, the opinions of technical experts, or the logic of the study team.

STRATEGY FOR MODEL DEVELOPMENT

In order to maximize the effectiveness and validity of a model, the evaluation of a service system utilizing cost-benefit modeling must be based on a carefully specified strategy for model development. One potential strategy is diagrammed in Figure 6.2. and discussed subsequently. This strategy is based on the format of a theoretically complete global model, an operational global model, and their respective sub-models.

Stage One - Identify Model Requirements

The first stage in model development is identifying the requirements for the model or model system. This necessitates delineation of the general purpose of the evaluative model, the potential users of the model, and the particular needs and concerns of the project team and potential user groups. As indicated, the model specification stage must be based on input from the potential users of the model rather than by the study team alone. This will increase the chances that the final form of the model will be responsive to the needs of its users.

Stage Two - Identify Anticipated Problems

The second stage of model construction is the identification of anticipated problems in the design, operationalization, implementation, utilization, and evaluation of the model. Among the problems that are typically identified are the unavailability of data, political constraints, disparity between the technical sophistication of the model builders and the model users, information processing limitations, financial restraints, reluctance of potential users to

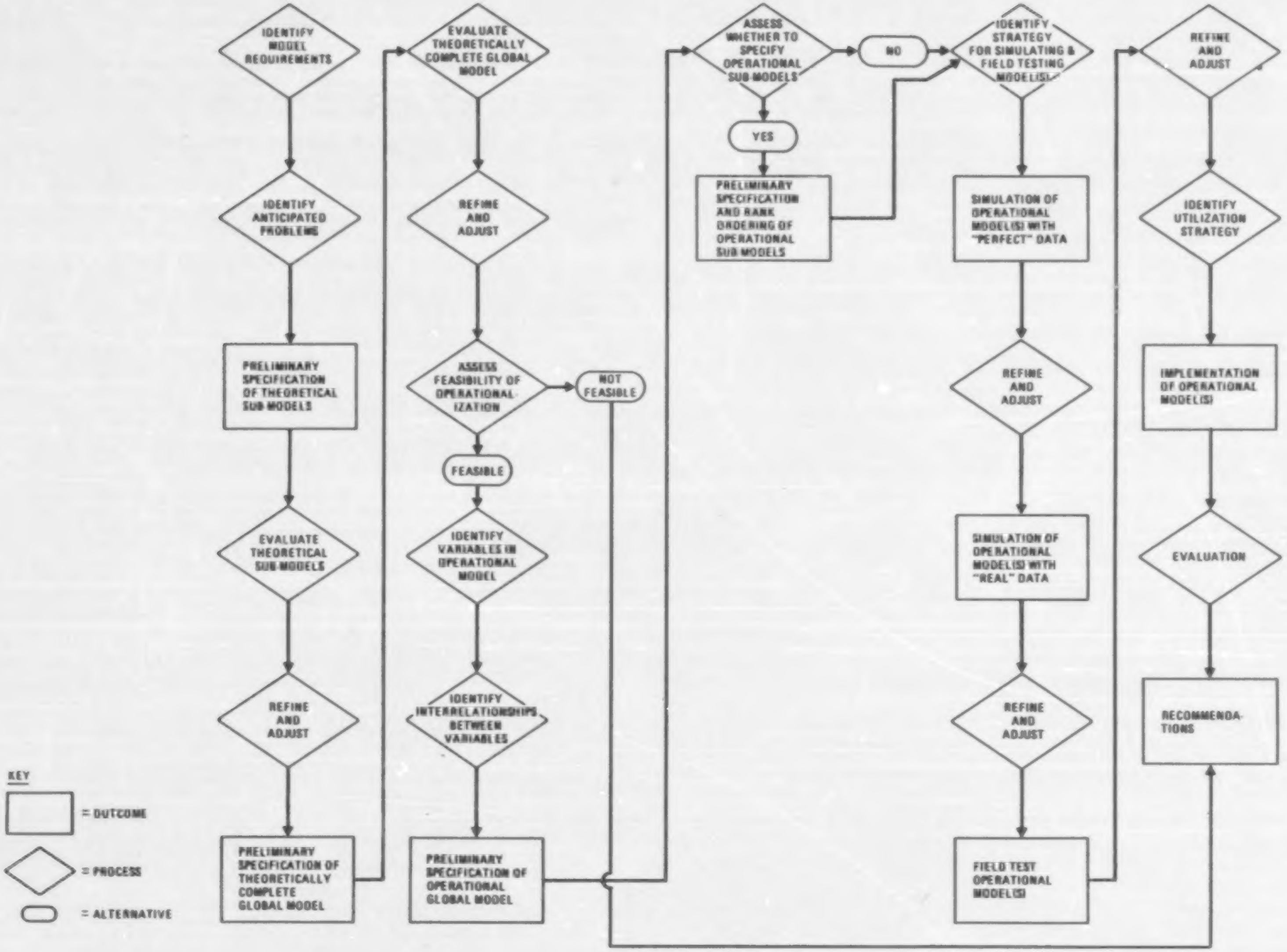
IDENTIFY MODEL REQUIREMENTS
IDENTIFY ANTICIPATED PROBLEMS
PRELIMINARY SPECIFICATION OF THEORETICAL SUB-MODELS
EVALUATE THEORETICAL SUB-MODELS
REFINE AND ADJUST
PRELIMINARY SPECIFICATION OF THEORETICALLY COMPLETE GLOBAL MODEL
EVALUATE THEORETICALLY COMPLETE GLOBAL MODEL
REFINE AND ADJUST
ASSESS FEASIBILITY OF OPERATIONAL-IZATION
NOT FEASIBLE
FEASIBLE
IDENTIFY VARIABLES IN OPERATIONAL MODEL
IDENTIFY INTERRELATIONSHIPS BETWEEN VARIABLES
PRELIMINARY SPECIFICATION OF OPERATIONAL GLOBAL MODEL
ASSESS WHETHER TO SPECIFY OPERATIONAL SUB-MODELS
NO
YES
PRELIMINARY SPECIFICATION AND RANK ORDERING OF OPERATIONAL SUB-MODELS
IDENTIFY STRATEGY FOR SIMULATING & FIELD TESTING MODEL(S)
SIMULATION OF OPERATIONAL MODEL(S) WITH "PERFECT" DATA
REFINE AND ADJUST
SIMULATION OF OPERATIONAL MODEL(S) WITH "REAL" DATA
REFINE AND ADJUST
FIELD TEST OPERATIONAL MODEL(S)
REFINE AND ADJUST
IDENTIFY UTILIZATION STRATEGY
IMPLEMENTATION OF OPERATIONAL MODEL(S)
EVALUATION
RECOMMENDA-TIONS
KEY
= OUTCOME
= PROCESS
= ALTERNATIVE

Figure 6.2 The Cost-Benefit Model Development Process

accept the model, and inability to measure accurately all the costs and benefits of a program. Again, identifying potential problems should be a cooperative effort between the model builders and proposed model users. If potential problems are anticipated in advance, a study team can investigate alternatives that will maximize the validity of a model given the projected restraints.

Stages Three and Four - Specify and Evaluate Theoretical Sub-Models and Theoretically Complete Global Model

Stage three is the preliminary specification of a series of theoretical sub-models. This stage combines the conclusions about model requirements (stage one) and potential problems (stage two) with technical information on the system being evaluated (e.g., vocational education) and the analytical approaches to relating program costs and benefits. After the preliminary specification, the models are reevaluated, refined, and adjusted. In stage four, the theoretical sub-models are integrated into a theoretically complete global model which is evaluated by the study team and potential users, and then further refined and adjusted.

Stage Five - Assess Feasibility of Operationalizing Model

Once the theoretical sub-models and theoretically complete global model are specified, the feasibility of creating an operational version of the model must be determined. This is done in stage five. It is appropriate for the potential users, as well as the model builders, to have input into this decision.

Stage Six - Identify Variables in Operational Model

If construction of an operational model is deemed feasible, the next stage in model development is to identify the variables to be incorporated into the operational model. Identification is accomplished by utilizing existing measures of variables that have been employed successfully in past research or by generating new measures (which must then be tested for reliability and validity).

Stages Seven and Eight - Identify Interrelationships between Variables in Operational Model and Create Hierarchy of Sub-Models

When variable identification is complete, the study team must construct the interrelationships between variables. These interrelationships must be consistent with general theory of the system being studied and with statistical theory. This stage culminates in the development of an operational global model. If only selected components of the operational global model are to be analyzed, a strategy for creating a hierarchy of sub-models must be developed. When this is completed, the operational global model or the operational sub-models selected must be subjected to evaluation via simulation and field trial.

Stage Nine - Simulations of Operational Model or Sub-Models

It is recommended that two simulation steps be utilized. The first is an evaluation of the model using "perfect" data fabricated specifically for this purpose. This artificial data set should be developed to reflect the range of possible model applications which might be found under real circumstances. This type of simulation will permit inspection of the model's ability to handle data and withstand manipulation. After this simulation, the model should be reevaluated and necessary refinements made.

The second simulation should use "real" data, that is, information from an existing data set. At this stage, the behavior of the model in the context of imperfect data collected for other purposes can be observed. This may uncover unanticipated additional limitations of the model. This second simulation should be carried out through the analysis and interpretation phases so that a relatively complete judgment may be made concerning the internal and external validity and reliability of the model. At this time, the model should again be reevaluated and any necessary adjustments made.

Stages Ten, Eleven, Twelve, Thirteen, and Fourteen - Field Test Operational Model or Sub-Models, Identify Utilization Strategy, Implement Model(s), Evaluate Model(s), Make Recommendations

The next stage in the model development process is a field test under fully operational conditions. This will provide a final examination of the quality of the model. The field test should be implemented in diverse situations which are representative of the anticipated applications of the global operational model or operational sub-models. The results of the field test will be used to make final adjustments to the model prior to identifying a strategy for utilizing the model, implementing the model, evaluating the model, and submitting recommendations.

THE BEGINNINGS OF A MODEL SPECIFICATION

In order to help assess the feasibility of performing a national cost-benefit analysis of vocational education, a very preliminary specification of the potential variables in this model was attempted. Once completed, the Delphi panel could evaluate the desirability and feasibility of operationalizing each of the variables.

To accomplish this preliminary specification, the study team simulated the first three stages in the model development process discussed in the previous section. This simulation was hampered by the fact that the general purpose and potential users of the cost-benefit analysis (stage one) were not yet fully known. As a result, a series of hypothetical purposes and user groups were identified to guide the model building process. These user groups along with their particular needs are summarized below:

- The Federal Government, whose needs might include allocating federal funds to the most efficient alternative programs.
- State governments, whose needs might include allocating state funds, and in the advent of block grants, federal funds, to the most efficient alternative programs.
- State education agencies, whose needs might include determining how to distribute school revenues to maximize educational output in their schools.
- Local education agencies, whose needs might include making efficient investments in alternative vocational programs.
- Educational institutions, whose needs might include increasing the efficiency of vocational programs.

- Individuals, whose needs might include determining whether vocational training will result in increased income, career advancement, or other benefits.
- Special needs populations, whose needs might include determining whether vocational training will result in various monetary and non-pecuniary benefits.

Stage two of the development process calls for the identification of anticipated problems in the design, operationalization, implementation, utilization, and evaluation of the model. This problem identification is intended to be a joint task between the model builders and model users. Since this is a simulation and user groups are presently unknown, the study team substituted input from various technical experts in both vocational education and/or cost-benefit analysis. A long list of potential problems was identified by the study team and technical experts. The major problems are summarized subsequently:

- Lack of available data types, particularly in the areas of program costs and student employment and wage histories;
- Lack of follow-up data;
- Disparities in the quality and timeliness of data between states;
- Resistance in the field to use of VEDS data, which is the most recent attempt at national data reporting in vocational education;
- Lack of information on the duration and exposure of vocational education;
- Lack of standard definitions of vocational education program enrollment;
- Difficulties in developing a model that meets the needs of diverse user groups;
- Problems in securing cooperation from potential user groups;
- Lack of acceptance or agreement among users of previous cost-benefit studies;
- Measurement inconsistencies between alternative analytical approaches to relating costs and benefits;
- Difficulties in selecting appropriate comparison groups;
- Difficulties in controlling for differences in non-educational variables between comparison groups;

- Difficulties in controlling for differences in program quality;
- Problems in treating the potential divergence between social benefits and costs and private benefits and costs;
- Difficulties in measuring joint costs;
- Difficulties in choosing between average cost and marginal cost methods;
- Difficulties in calculating the opportunity costs of vocational enrollment;
- Difficulties in measuring the consumption benefits of vocational training;
- Difficulties in measuring non-pecuniary benefits and costs;
- Difficulties in translating non-pecuniary benefits and costs into monetary values;
- Difficulties in interpreting the impact of an earnings multiplier effect;
- Problems in determining appropriate discount rates;
- Difficulties in formulating a concise operational model given the breadth of vocational education; and
- Financial restraints.

The last two limitations suggest one additional problem. Since the vocational education enterprise is so diverse, a series of operational sub-models composed of different variables needs to be developed. Given funding limitations, it is unlikely that all the sub-models can be implemented. Therefore, a final problem facing a national cost-benefit study team is determining an acceptable strategy to prioritize the sub-models.

Stage three of the development process is the actual specification of the variables in the model and their interrelationships. In its most general form, a cost-benefit model of vocational education can be broken down into two functional equations:

$B = f(X_1 \ldots X_m, X_n \ldots X_z)$, where

B = The benefits of vocational education

$X_1 \ldots X_m$ = Monetary benefits

$X_n \ldots X_z$ = Non-pecuniary benefits and

$C = f(Y_1 \ldots Y_m, Y_n \ldots Y_r, Y_s \ldots Y_y, Y_z)$ where

C = The costs of vocational education

$Y_1 \ldots Y_m$ = Current costs

$Y_n \ldots Y_r$ = Capital costs

$Y_s \ldots Y_y$ = Opportunity costs

Y_z = Interest on school debt

Table 6.1 breaks down each of the broad categories included in the functional equations into its component parts.

Specifications of the model also depend upon the functional relationships between variables. Among the factors that affect the nature of these functional relationships are:

- Selecting a measurement strategy for joint costs;
- Selecting marginal or average cost methods;
- Selecting an appropriate discount rate;
- Choosing comparison groups;
- Choosing a unit of student participation;
- Controlling for cost differentials between districts;
- Controlling for differences in non-educational variables between students;
- Controlling for differences in program quality;
- Treating the divergence between social benefits and costs and private benefits and costs; and
- Interpreting the impact of an earnings multiplier effect.

Clearly, this specification of the model is preliminary and quite general. However, this broad specification is adequate to identify the basic components of a cost-benefit analysis of vocational education. The desirability and feasibility of utilizing these components in a national study can be assessed by soliciting reaction from a panel of experts in the areas of vocational education and/or cost-benefit analysis. The results of such a survey of experts are reported in the final section of this chapter.

TABLE 6.1. A Partial Listing of Potential Variables in a Cost-Benefit Model of Vocational Education

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Monetary Benefits

- Annual income
- Fringe benefits (e.g., health insurance, vacations with pay)
- Monetary benefits accruing to students who enroll in vocational classes purely for consumption purposes

Non-Pecuniary Benefits

- Greater job opportunities
- Contentment with educational training
- Higher job satisfaction
- Positive work attitude
- Employers' satisfaction with employee performance
- Permanence of job
- Lower crime rates
- Better citizenship
- Greater sense of well being

Current Costs

- Administration costs
- Instructional costs
- Costs of plant operation
- Costs of plant maintenance
- Fixed charges
- Costs of other school services

Capital Costs

- Building costs
- Land acquisition costs
- Costs for major equipment

Opportunity Costs

- Foregone Income
- Cost of using plant for alternative purposes

DELPHI ANALYSIS

Delphi analysis is "a method for the systematic solicitation and collation of informed judgments on a particular topic."[1] In this methodology, information is usually collected from a respondent group through a survey instrument. However, the methodology is significantly different from standard survey design.

For example, respondents are sent a series of questionnaires at established intervals. Each subsequent questionnaire builds on the issues raised or the responses received in the previous questionnaire. There are typically 2 to 4 rounds of questions, although some Delphi exercises may be longer.

The Delphi methodology is also distinct from traditional survey designs because it includes a well-defined mechanism for group feedback. That is, respondents are usually sent a summary of the results of previous iterations of the questionnaire as well as any additional opinions volunteered by other panelists. The logic behind the feedback component of the Delphi methodology is that it allows the diverse expertise of the respondent group to be shared with other panelists, and participants to be informed of the degree of consensus or polarization in the group.

A third unique aspect of the Delphi technique is that it encourages participants not to feel constrained by the formal survey instrument. Respondents are encouraged to critique, rewrite, or suggest new questions; to write justifications of their answers; and/or to include general comments on the issues being discussed.

The typical respondent group in a Delphi exercise also varies from that in a traditional survey. Respondents are usually technical experts in a given field or senior members of an organization. They are selected specifically because of their expertise and, therefore, are not a random sample of the general population. The number of respondents in an average Delphi analysis ranges between 10 and 50.

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[1] M. Turoff, "The Design of a Policy Delphi," Technological Forecasting and Social Change. 2 (1970), p. 149.

The Delphi technique may serve numerous objectives. Turoff suggests that these objectives include:[2]

- Determining or developing a range of possible alternatives;
- Exploring or exposing underlying assumptions or information leading to differing judgments;
- Seeking out information which may generate a judgmented consensus on the part of a respondent group;
- Correlating informed judgments on a topic spanning a wide range of disciplines; and
- Educating a respondent group to the diverse and interrelated aspects of a topic.

The Delphi approach has certain similarities to decision making by committee. In both techniques a small group of experts attempts to reach a consensus on important policy issues. However, proponents of the Delphi method suggest that it has certain advantages over decision by committee. For example, an outspoken personality cannot dominate a Delphi exercise as he/she can a committee meeting. In addition, respondents may be less hesitant to criticize opposing views in a Delphi exercise since anonymity is usually guaranteed. Similarly, since respondents do not meet face to face, an individual may be less reluctant to abandon one position to support a second based on feedback from other panelists.

Use of the Delphi technique was pioneered in the early 1960's by researchers involved in technological forecasting. The earliest exercises asked respondents to predict when technological changes may take place and the impact of the changes. Since that time, the Delphi methodology has become an accepted analytical tool in diverse technological and policy areas.

DESCRIPTION OF THE DELPHI METHODOLOGY

A Delphi exercise was not an original component of this study's research design. The Delphi was proposed in response to the change in study scope early in the project. The Government Request for Proposal called for a project that would design and field test a cost-benefit model applicable to a national study of vocational education. Consistent with the model development strategy discussed earlier, the study's Technical Advisory Committee noted that field testing an operational model was premature until a careful analysis was made of the feasibility of building and implementing such a model. Therefore, the study orientation changed from field testing a model to assessing the feasibility of a model. One tool proposed to assess this feasibility was a Delphi analysis.

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[2] Turoff, P. 149

The Delphi methodology is not a substitute for careful analysis. Rather, it should be one component of a thorough analysis plan. Therefore, the Delphi exercise is just one of several methods employed by this project to assess the feasibility of performing a national cost-benefit analysis of vocational education. Other equally important aspects were an evaluation of the state of the art in cost-benefit analysis and a rigorous review of potential measurement problems that was based on an extensive literature survey and informal conversations with technical experts.

The fact that the Delphi analysis was not an original part of the research design but a response to a change in study scope affected the size of the respondent group. In order to maintain the established project schedule, the number of respondents was limited to nine, the maximum number allowable without undergoing the time consuming process of obtaining Office of Management and Budget (OMB) approval of the survey instruments and design. The respondent group was composed of all members of the project's Technical Advisory Committee, one member of the agency sponsoring the research (the Office of Vocational and Adult Education), and two representatives of state departments of vocational education. All members of the Delphi panel were experts in vocational education and/or cost-benefit analysis. The names of the Delphi panelists are included in this report as Appendix D.

The Delphi exercise ran for three rounds. The first two rounds consisted of a mail survey. Due to time limitations, the third round was scheduled as a conference at Rehab Corporate headquarters.

Panelists were given approximately nine days to respond to the mailed questionnaires. Seven of the nine panelists responded to the first round and all panelists submitted round two questionnaires. The Delphi design team utilized one week to feedback the results of round one to the respondents and to structure and mail the second round questionnaire. An additional week was used to plan for the third round conference. The entire Delphi process, from the first mailing to the third round conference, took just over six weeks. This does not include the considerable time spent planning and designing the exercise in advance of the round one mailing. Prior to both mailings, all questions and instructions were pretested on co-workers of the Delphi design team.

The mailing package for rounds one and two consisted of a cover letter, an explanation of the evaluation system used in the survey, and two copies of the questionnaire. The explanation of the evaluation system and the round one and two questionnaires are exhibited in Appendix E.

The reasons for the duplicate questionnaire were threefold. First, it could assist a panelist in planning his responses. Second, it could be used as a record of a panelist's responses which later could be compared to those of the overall group. Third, after planning one's responses, the answers could be typed onto the second questionnaire in order to help assure the anonymity of respondents.

The questions in all rounds were divided into three categories. These categories were:

- The general design of a national cost-benefit study of vocational education
- Measurement issues and problems
- Data availability

However, the response mode differed for each round. In round one, panelists were instructed to evaluate each response option to a question according to a desirability scale (very desirable, desirable, undesirable, and very undesirable) and a feasibility scale (definitely feasible, possibly feasible, possibly infeasible, definitely infeasible). Note that no neutral answer was available on the response scales. Each of the descriptors of desirability and feasibility was followed by a brief explanation or definition. The explanations are shown in Table 6.2. These explanations help establish comparability among responses even though the definitions may not be universally agreed upon.

In round two, panelists were asked to rank the desirability of each response option in order of personal preference. No ties were permitted between response options. Round two also included one series of open-ended questions. It allowed respondents to suggest important additional issues and questions in designing a national cost-benefit study of vocational education that may have been overlooked by the design team. These questions asked respondents to:

- List two major obstacles in performing a national cost-benefit analysis of vocational education.
- Describe a strategy for overcoming, minimizing, or dealing with each specified obstacle.
- Suggest two questions that should be addressed by a research team in designing a national cost-benefit analysis of vocational education.

In the instructions accompanying the first and second round questionnaires, respondents were encouraged to justify their responses, express opinions, rewrite questions, or suggest new questions. The instruction sheet explained that the questionnaire was "meant to be a stimulus for thought on the feasibility of performing a national cost-benefit analysis of vocational education." To facilitate and encourage comments, the questionnaire was laid out so that the right hand page opposite each question was blank with room for commentary. The responses to and comments on all questions in rounds one and two are summarized in Appendix F. A transcript of the round three conference has been submitted under separate cover.

Many of the issues for the third round conference were developed from panelists' responses to the round two open-ended questions that asked for lists of potential obstacles facing a national cost-benefit study team, strategies to overcome the obstacles, and additional questions that must be addressed in designing a national study. Responses to these third round

Table 6.2. An Explanation of the Evaluation System Used in the Delphi Questionnaires

DESIRABILITY (EFFECTIVENESS OR BENEFITS) RESPONSE SCALE

DESCRIPTOR	EXPLANATION
Very Desirable	will have a positive effect and little or no negative effect; extremely beneficial; justifiable on its own merit.
Desirable	will have a positive effect, negative effects are minor; beneficial; justifiable as a by-product or in conjunction with other items.
Undesirable	will have a negative effect; harmful; may be justified only as a by-product of a very desirable item, not justified as a by-product of a desirable item.
Very Undesirable	will have a major negative effect; extremely harmful; not justifiable.

FEASIBILITY (PRACTICALITY) RESPONSE SCALE

DESCRIPTOR	EXPLANATION
Definitely Feasible	no hindrance to implementation; no political roadblocks; acceptable to the public.
Possibly Feasible	some indication this is implementable; further consideration or preparation must be given to political or public reaction.
Possibly Infeasible	some indication that this is unworkable; siginificant unanswered questions.
Definitely Infeasible	all indications are negative; unworkable; cannot be implemented.

questions were solicited using the format of a round-table panel discussion. Respondents were encouraged to express their views on each issue but were not required to participate in every aspect of the discussion.

The third round of the Delphi exercise was plagued by the three major problems. First, the study team was reluctant to bring the panelists together for a face to face meeting. Although this was deemed an appropriate mechanism to summarize the issues debated in rounds one and two, it threatened the anonymity that had been established in the exercise. Nevertheless, the meeting was scheduled as a concession to project time constraints. Second, it was difficult to arrange a conference date that was amenable to all nine panelists. Six of the nine participants committed themselves to attend the meeting on the date selected. Third, various last minute factors, including the air traffic controllers strike, forced a number of committed respondents to miss the meeting. Anticipating the possible effects of the air traffic controllers strike, the study team decided to invite additional technical experts to the meeting. A total of six people attended the third round conference. However, only two of them had served as panelists for the earlier rounds. A list of conference attendees is included as Appendix G.

As a result of the turnover in panelists, the conference functioned more as a fact finding meeting than as the third round of the Delphi exercise. Nevertheless, the meeting produced numerous contributions to assessing the feasibility of a national study. The agenda for the third round meeting is shown in Appendix H.

DELPHI RESULTS

Several general characteristics of a cost-benefit model for a national study of vocational education were specified earlier in this chapter. This section reports the criticisms of a nine member Delphi panel on many of these characteristics.

The Delphi analysis solicited responses from the panel of experts on the desirability and feasibility of several design, measurement, and data base options. The panelists are all recognized experts in vocational education and/or cost-benefit analysis. However, their opinions must not be interpreted as necessarily representative of the vocational education community at large. As is often the case in a Delphi analysis, the size of the panel and the method of panel selection mitigates against the generalizibility of the results. Readers should, therefore, recognize the limitations in these opinions. The limitations in the methodology were accepted a priori by the study team. This is why the Delphi survey was designed as but one of a series of components in assessing the feasibility of conducting a national study.

Results on General Study Design

As previously indicated, potential users of a cost-benefit model should have input into its design at various stages of the development process. Therefore, identification of user groups will have a significant impact on the ultimate specification of the model. The Delphi panelists ranked state agencies closely followed by the Federal Government as the potential user groups most in need of the information that could be generated from a national cost-benefit model of vocational education. It is apparent from some of the comments made by panelists that the current political and economic environment influenced their rankings of potential user groups. Respondents who selected state and local governments cited their increased information needs based on the prospective growth in block grants. The choice of the Federal Government was defended because of the need to make efficient budgetary decisions during a period of spending cuts.

A second design issue examined in the Delphi is determining the optimal breadth of the proposed model. Nearly all respondents indicated through their comments that they are aware of the diversity of the vocational education enterprise. Given this diversity, the respondents were asked to choose between implementing a broad and versatile model that would provide meaningful results to many or all potential users and on varied programs; a series of models that would separately address the information needs of different users and the characteristics of different programs; or a compact model that would focus on a single user, program area, program level, or delivery system. The panel favored the construction of several unique models. They also felt this type of model construction was the most feasible alternative. Interestingly, although the panelists rated a series of compact models first, they alternatively preferred a broad and versatile model to a single compact model. Apparently, they feel that it is necessary to generate information on various elements of vocational education even if it means a trade off in the specificity of the model.

It is important to realize that the issue raised in this question concerns determining the characteristics of the model to be implemented, not the characteristics of the model to be designed. According to the strategy for model development presented earlier, it is necessary to design a theoretically complete global model. From that model, an operational global model and a series of operational sub-models may be constructed. A study team, in consultation with potential user groups, may select which operational sub-models should be implemented. This model design process is summarized by one of the Delphi respondents:

> A broad general model can be used as a starting point for specifications to meet particular needs and interests. Moreover, construction of a narrowly focused model may be better achieved by specification of a general one (top down) than by ad hoc construction (bottom up).

Three factors that could conceivably affect the breadth of the model design are the current availability of data, the level of available resources, and model construct capabilities. The Delphi panel clearly concluded that in an ideal situation, cost considerations and current availability of data should be subordinate to model construct capabilities in designing a cost-benefit study. However, data and funding limitations are a realistic concern. One respondent's comments summarize these viewpoints:

> Given that 1) current data availability and potential resources for the study pose severe programmatic constraints, and 2) the quality of study activities and findings are dependent upon a solid, comprehensive model design, the consideration of model construct capabilities are paramount. Of course the delimiting factors cited in point 1 (data and resource availability) will necessitate flexibility in the development of the model.

Should cost considerations dictate narrowing the scope of the study to one particular education level, the panelists favored examining secondary vocational education first, postsecondary vocational education second, and adult vocational education a distant third. The Delphi respondents clearly rejected the option of an aggregated examination of secondary, postsecondary, and adult vocational programs as a cost-saving alternative. In the words of one panelist:

> The types of benefits differ considerably by institutional level. For example, while job placement rates and earning levels might be the most appropriate benefit measures for postsecondary and adult programs, the benefit of secondary programs might be most appropriately judged by levels of skill proficiency or attitudinal changes. Consequently, I do not see how an aggregate benefit assessment across institutional levels could be fairly constructed.

Under ideal conditions, respondents feel that the most informative study should include and distinguish between the various program levels of vocational education. They similarly believe that the potentially differing efficiencies among vocational program types and delivery systems should be analyzed as part of a national cost-benefit study. Concerning vocational program types, respondents indicated a desire to distinguish between the returns of specific programs within broad program areas. However, they assessed this distinction as potentially unworkable and, therefore, infeasible. Thus, distinctions between programs may have to be made between broad program areas only.

Results on Measurement Issues

The model specified in this chapter breaks vocational education benefits into two categories: economic benefits, which can be measured by annual income, and non-pecuniary benefits. Based on various respondent comments, non-pecuniary benefits appear to be the most difficult aspect of the study design to handle. Clearly, panelists feel that they should be a component of the study. Interestingly, although there is great concern over how to incorporate non-pecuniary benefits into the analysis, and strong criticisms aimed at cost-benefit analysis for its inability to reflect these benefits, the consensus of the panel is that such incorporation in some form is feasible. Apparently, this viewpoint is based on the increased attempts to operationalize non-pecuniary costs and benefits in existing cost-benefit studies. As one panelist comments, "Multi-criterion benefit-cost models are beginning to emerge and should be looked into."

A second issue raised in the model specification was how to treat joint costs. Joint costs are costs incurred when an educational input, such as a piece of equipment or school building, is used by more than one student group. Allocation of joint costs presents a difficult measurement problem. Several treatment options exist, including excluding them from analysis, evaluating the marginal cost of their use, evaluating the average cost of their use, and evaluating them using game theory. Average cost of use was the most desirable method of evaluating joint costs to the panelists, with marginal cost of use a close second. Since marginal and average cost methods may be relevant in different situations, an optimal alternative might be to use both costing techniques. One panelist, using similar logic, called for the judicious use of average costing, marginal costing, and game theory in a cost benefit analysis:

> For starting a new added program, marginal costs may be the best; for evaluating a whole system, average cost is attractive; game theory methods are relevant when considering several different added programs or combinations thereof.

A third component of the model specified in the previous section was a discount rate. Utilizing a discount rate in cost-benefit analysis permits the evaluator to equate future income with present values. The panelists favored using the rate of inflation as the means of measuring the discount rate. This option was more desirable than either the prime rate of interest or the rate of interest on government treasury bills. Surprisingly, the overall second choice of the Delphi panelists was to exclude a discount rate from the study. However, there was extreme polarization on this response category.

As specified in the model, a student may be enrolled in vocational education both for investment and consumption reasons. Some critics have contended that it is unreasonable to support expensive vocational programs on the basis of non-investment benefits when non-vocational education programs are being underfunded. Panelists, however, supported the presence of consumption benefits in the model. Nevertheless, they rated the feasibility of accurately measuring the level of consumption benefits as quite low.

A vocational education graduate's increased earnings will have a ripple effect throughout the economy, as he/she spends money and increases someone else's income. This was termed an earnings multiplier effect in the model specification. The panelists judged that this earnings multiplier effect should be considered in a cost-benefit study. They did recognize, however, that consideration, while desirable, is somewhat less feasible because of its measurement difficulty.

The opportunity cost of attending a vocational education program may enter into a cost-benefit model as one of the largest cost components. The panelists concurred that use of foregone income as a measure of the opportunity costs of attending school was desirable and relatively feasible. The proxy for foregone income deemed most desirable was the average earnings of individuals with similar characteristics who are not attending school.

The model specification section also suggested that social costs and benefits may diverge from private costs and benefits. Therefore, determination of which entity is the proper basis for a cost-benefit analysis will impact the study results. Panelists indicated that measurement of both private and social costs and benefits are desirable and feasible in a national study.

Another model specification issue that will have serious implications for the succeeding analysis is the choice of a comparison group. Concerning secondary vocational education, respondents concluded that the most logical comparison group was students in a general education program. However, the panelists were somewhat temperate in their support of this option in that comparisons with other alternatives were ranked just below general education programs. These included students attending a college preparatory program, individuals not attending secondary school, and a weighted average of all three activities. For all comparison formats, panelists raised definitional and data availability problems in measurement.

Panelists were evenly divided between students in two year general curriculum colleges and individuals not attending postsecondary schools in their choice of an optimal comparison group for postsecondary vocational education. Regardless of the level of education analyzed or the choice of comparison group, it is important to attempt to control for differences on non-educational variables between groups.

In an effort to distinguish between program enrollees and individual course takers, respondents supported "enrollment in a fixed series of related vocational classes" as a superior definition of a program participant for the model. Further, they agreed that full time equivalent (FTE) students was a more suitable method for counting students than either ADA, ADM, or the average of ADA and ADM. An alternative measurement format was suggested by one panelist:

> FTE is an excellent measure of load on the system. However, seriousness of participants is measured by average daily attendance. I suggest (as an alternative) the measure:
>
> (Number of hours per week) X (Number of enrollees) X R
>
> where R is a reduction factor to account for absentees. R should probably not be linear.

One final factor examined in the Delphi that could impact on the results of a cost-benefit study is the treatment (and possible weighting) of differences in program quality. Measuring differences in the quality of vocational programs was judged to be highly desirable yet possibly infeasible by the majority of panelists. Panelists emphasized the need for delicacy in program quality measurement criteria, noting the potential political impact of such measures.

Results on Data Availability

There are several sources of data that could be used in a national cost-benefit study of vocational education. Delphi panelists specified that utilizing existing data bases supplemented by some new data collection was the preferable strategy for securing data in a national study. This option was preferred to relying solely on existing data bases or conducting a data collection survey exclusively for the national study.

Respondents were also queried on the desirability and feasibility of using a number of different existing sources as the basis for the national study's data. These sources were:

- National Center for Education Statistics' (NCES) Vocational Education Data System (VEDS)
- Bureau of Occupational and Adult Education's (BOAE) Statistical Reports (1973-1978)
- NCES' High School and Beyond Longitudinal Survey (1980)
- Department of Labor's (DOL) National Longitudinal Survey (1979)
- NCES' National Longitudinal Survey of the High School Class of 1972
- National Institute of Education's (NIE) Survey of Vocational Schools in Ten States (1980)
- NCES' Survey of Non-collegiate Postsecondary Students and Schools (1972-1980)
- Assistant Secretary for Planning and Evaluation's (ASPE) Survey of Vocational Education Students and Teachers (1972)
- Office of Civil Rights' (OCR) Survey of Vocational Education Schools (1979)
- Office of Education's (OE) "437 Files" (Grants and Expenditures under State Administered Programs)
- Census Bureau's Current Population Survey Supplement
- Project Talent Data Base
- NCES' Survey of Course Offerings and Enrollments (1973)
- Survey Research Center's Youth in Transition Data Base (1966)

No sound conclusions were made by the Delphi panel about the desirability or feasibility of using these various sources. Rather, many respondents expressed uncertainty about the contents of the alternative data bases. It is interesting to note, however, that of the four respondents knowledgable about VEDS, two rated the data source undesirable. VEDS has come under sharp attack by many in the field for being duplicative and unnecessary.

The results of the Delphi analysis were carefully considered in assessing the feasibility of performing a national cost-benefit study of vocational education. Conclusions regarding the feasibility of a national study and recommendations for future cost-benefit research on vocational education are the focus of the final chapter of this report.

CHAPTER 7

RECOMMENDATIONS AND CONCLUSIONS

INTRODUCTION

This chapter reports the recommendations and conclusions concerning the feasibility of performing a national cost-benefit analysis of vocational education. These recommendations and conclusions are based on the interactive series of research tasks described throughout this report. The first relevant task was an extensive analysis of the state of the art in utilizing cost-benefit methodologies to evaluate vocational education. The second task was a comprehensive review of the measurement problems that might confront a study team performing a national cost-benefit analysis of vocational education. The third source contributing to the remarks made in this chapter was the Delphi analysis of the desirability and feasibility of operationalizing the variables in the simulated cost-benefit model.

The chapter begins by discussing the feasibility of conducting a national cost-benefit study of vocational education. This is followed by an analysis of the potential value of conducting a national study. Finally, recommendations are made for future research on the costs and benefits of vocational education.

FEASIBILITY OF PERFORMING A NATIONAL STUDY

The results of the state of the art review, assessment of potential measurement problems, and Delphi analysis suggest that a national cost-benefit study of vocational education is technically feasible. However, this assessment must be viewed in terms of the current level of sophistication in relating costs and benefits.

There are numerous limitations in specifying the relationship between vocational education costs and benefits. These limitations fall primarily into three categories: analytical evaluation techniques that relate costs to benefits, methods for measuring costs and benefits, and characteristics of vocational education.

Concerning the first two categories, alternative analytical techniques and measurement methods are available to cost-benefit study teams. Each technique and method has its advantages and disadvantages. A cost-benefit evaluator must understand the strengths and weaknesses of the techniques and methods he/she employs in that they will have a serious impact on the study findings.

The characteristics of vocational education, the third category of limitations in applying cost-benefit methodologies to vocational education, are a problem only in terms of their breadth. Vocational education cannot be simply defined or neatly categorized. It is a complex enterprise consisting of multiple program levels, program areas, institutional settings, and student populations. One of the dangers of applying cost-benefit methodologies to vocational education is that these idiosyncrasies may be ignored. A study that makes no effort to distinguish between the diverse components of vocational education may only mask the actual relationship between program costs and benefits.

Therefore, cost-benefit analysis, based on existing technologies, is an imperfect analytical tool. Not all theoretically appropriate variables in a cost-benefit model may be operationalized. Other variables may be operationalized but only by using imprecise proxy variables. Consequently, in most cost-benefit analyses dealing with social issues, there is a significant deviation between the theoretically complete global model and the operational global model. Nevertheless, most modeling, measurement, and data obstacles can be overcome to the point where the product of a cost-benefit analysis is useful and reliable.

The state of the art review in Chapter 3 illustrates that a large number of cost-benefit analyses of vocational education have been conducted on a sub-national level. Although the logistics of a national study will be substantially more imposing than those on a sub-national basis, each must confront many of the same technical obstacles. The smaller studies have proven that these limitations can be surmounted. They also demonstrate that a cost-benefit study can contribute to the understanding of vocational education.

A national study faces numerous unique difficulties as well. Many of these problems are addressed in the last section of this chapter on the recommendations for a national cost-benefit study. These problems must be given careful attention by a national cost-benefit study team. However, they are not fatal to executing a national study.

UTILITY OF PERFORMING A NATIONAL STUDY

A national study of the costs and benefits of vocational education should not be implemented solely based on its technical feasibility. In addition, the utility of a national study must be assessed prior to committing scarce revenues to the research. The utility of performing a national study is considered in this section.

A national cost-benefit study should prove useful for a number of reasons. First, cost-benefit analysis of vocational education can contribute to sounder policy decisions. The results of a cost-benefit analysis, even if based on an imperfect model, can lead to decisions superior to those based merely on subjective judgment.

Second, the results can be used on the sub-national as well as national level. With the prospect of increased block grants in education, state and local agencies need more information on the relationship between program costs and benefits in order to help make good policy decisions. Given scarce resources, the relationship between costs and benefits is a rational basis on which to make such decisions. Therefore, a national study can contribute to more informed decision-making at the state and local levels.

Third, in the process of building a theoretical model of the costs and benefits of vocational education, a study team can help pinpoint crucial data needs. That is, in an effort to operationalize the model, the study team must assess which data are available, which are reliable, and which are duplicative. This identification process can potentially contribute to reducing the data burden that currently exists in vocational education.

Fourth, the results of a national cost-benefit study will complement existing evaluative research on vocational education. In particular, the national study will be a useful adjunct to the research conducted by the Congressionally mandated NIE Vocational Education Study. The information generated by the two studies will produce a wealth of data on the present state of vocational education.

As with any analytical technique, there is the possibility that the results of a cost-benefit analysis can be misused. For example, some may treat the results of such an analysis as a magic formula that can conclusively allocate scarce funds among alternative programs. The methodological limitations inherent in the technique are too great to base such decisions solely on the results of a cost-benefit analysis. Nevertheless, cost-benefit analysis can provide significant input into making such policy decisions. That is, when used as one component in a multi-criteria policy evaluation, rather than indiscriminately, cost-benefit analysis can be an informative policy-relevant tool.

RECOMMENDATIONS FOR A NATIONAL COST-BENEFIT STUDY

This section presents recommendations for consideration in planning a national cost-benefit study of vocational education. These recommendations pertain to funding limitations, user groups, data problems, modeling considerations, and measurement problems.

Funding Limitations

As a result of Federal efforts to balance the budget, revenues for program evaluation are becoming scarce. Ironically, program evaluation methodologies can help policy makers allocate scarce dollars more intelligently. Given the current fiscal environment, implementing a global operational model, although the optimal choice in designing a national cost-benefit analysis of vocational education, is improbable. Therefore, a hierarchy of sub-models must be created and the sub-models implemented subject to available funding. Given present funding limitations, the following recommendations are made:

- The cost-benefit study should not be conducted on a national basis, but rather, with national considerations. Therefore, a sampling plan must be developed that represents the many diverse characteristics of the vocational education enterprise.
- If a choice must be made among program levels, the first priority should be an analysis of secondary vocational education. This is because secondary vocational education has a higher enrollment, utilizes more revenues, and probably has more thorough and accessible data than postsecondary or adult vocational education.
- Since a national study will be Federally funded, the analysis must first serve Federal policy determination needs. It is preferable, however, for the study to meet the needs of more diverse users.
- If a national study cannot be funded, a less costly alternative might be to provide technical assistance to the states to help them develop the skills to conduct their own cost-benefit analyses. With the prospective advent of block grants, this investment in capacity building on the state level should prove beneficial.

User Groups

Information from a national cost-benefit study can be used by diverse groups, including the Federal Government, state agencies, local agencies, parents and students, and special needs populations. The following recommendations are made concerning user groups:

- If funding levels permit, at a minimum the study should be designed to fulfill the needs of both the Federal Government and state agencies. The information needs of state agencies will be increasing in the current fiscal and political environment.
- Given existing set-aside requirements for special populations, the study should attempt to serve the needs of state and Federal special education program administrators in the area of vocational education.
- In order to increase the acceptance of the study by potential users, user groups should have substantial input into the design of the cost-benefit model.

Data Problems

Disparities in the availability and quality of data among states is a serious obstacle to performing a national cost-benefit study. The following recommendations address these and various other data problems:

- Since it has been proposed that a national study be conducted on a sample basis, the sampling plan should reflect an awareness of data availability and data quality disparities. If possible, states should be included in the sample only if they have available:
    - data on program costs
    - data on student employment and wage histories
    - reliable enrollment data
    - enrollment data sensitive to differences in duration and exposure
    - student follow-up data
    - data files that are updated regularly
- Accurate definitions of various data types must be created. The study team must be sensitive to possible inconsistencies in definitions between states.
- The study should utilize existing data wherever possible and only supplement these data with new data collection if necessary. New data collection should be kept to a minimum given the current attitude at the state and local level that too much duplicative and unimportant data are already demanded.
- One task in the national study can be identifying unreliable and duplicative data elements that are collected through national reporting mechanisms, particularly VEDS which is the newest and perhaps most criticized mechanism. This information could be gathered as a by-product of scrutinizing national data sources for possible use in the cost-benefit analysis.
- A parallel study should be funded that utilizes the results of the previous task and formulates strategies to reduce the data reporting burden faced by states and localities. These strategies might include:
    - creating a vocational education management information system (MIS) to process available data more efficiently

- adding or deleting data types in statutory reporting systems
- standardizing acceptable surrogates of unavailable or unreliable data
- standardizing data definitions
- standardizing data reporting requirements

Cooperation with the cost-benefit study team and, therefore, acceptance of the study findings may increase if user groups are shown that the research will help reduce their data reporting burden.

Modeling Considerations

For cost-benefit research to be most valuable, a strong commitment must be made to a thorough model development process. Very often, knowledge gained from the modeling process is as significant as the actual results of a cost-benefit study. The following recommendations are made pertaining to model development:

- To maximize the acceptance of the model, the model building process must be fully documented.
- A national cost-benefit study should be required to include specification of a theoretically complete global model, creation of an operational global model and sub-models, model simulation, model field testing, implementation, and evaluation.

To best execute this comprehensive process, it may be preferable to fund a series of consecutive studies, each performing one or more steps in the modeling process, rather than one major study.

Measurement Problems

There are numerous obstacles to measuring accurately the costs and benefits of vocational education in a national cost-benefit study. However, many of these obstacles can be overcome or their effects acceptably minimized by a knowledgable model building team. A number of recommendations are made concerning measurement issues:

- Multiple analytical methods should be employed to assess the relationship between vocational education costs and benefits. This is because alternative analytical approaches can produce varying results under certain conditions.
- The study must include both monetary and non-pecuniary costs and benefits in its design. Although measurement of the latter is difficult, there are numerous acceptable proxy variables that represent non-pecuniary costs and benefits. A model that dismisses non-pecuniary costs and benefits with the disclaimer that "since they can't be measured, they will be omitted" is seriously deficient.
- In a cost-benefit model of vocational education, both private and social costs and benefits must be calculated.
- Since each may be appropriate in different situations, both average cost and marginal cost methods should be included in the analysis.
- The cost-benefit study team should attempt to incorporate game theory in allocating joint costs. The assumption that allocating joint costs is not a problem for the study since the marginal costs are zero is not appropriate under all conditions. One such example is allocating costs among ongoing programs.
- Because of the breadth of vocational education, over-aggregated data collection and analysis must be avoided. A cost-benefit analysis must recognize the potentially varying efficiencies of vocational education by program level, program area, delivery system, and student population group.
- It is feasible to include in the cost-benefit model a rate that discounts future benefits to present values and the opportunity costs of participating in vocational programs (measured, for example, by foregone income).
- Model builders should investigate the possibility of including consumption benefits, an earnings multiplier effect, and a control for differences in the quality of vocational programs in the model. Including these factors may not be feasible. However, their omission from the model is not fatal.

APPENDIX A
LITERATURE ABSTRACTS

Economics of Education

Averch, H. A., Carroll, S. J., Donaldson, T. S., Kiesling, H. J. and Pincus, J. How Effective is Schooling?: A Critical Review of Research. Englewood Cliffs, NJ: Educational Technology Publications, 1974.

This source summarizes the paramount methodological and measurement issues in relating school inputs to educational outputs. For example, the authors discuss alternative definitions of school output. They note that various student test scores are the most often used output measure. Although these tests do measure certain important aspects of the learning process, the authors contend that they have severe limitations as well. Student test scores appraise only a limited range of the many cognitive abilities learned in school. Also, they are often culturally biased and do not accurately measure the skills of minority groups.

Averch, et al. also review the various methodologies for measuring the productivity of educational resources. They discount the policy relevance of process techniques that attempt to measure the variations in the effect of the schooling process (teaching methods, curriculum, etc.) on output through laboratory observation. They write:

> Sometimes, to minimize the extent to which a student's previous learning experiences affect the outcome of an experiment, they deliberately examine learning tasks that are very unlike the learning tasks encountered in the classroom--memorizing lists of nonsense syllables, for example. Consequently, the results of the experiment offer little direct policy guidance.

The authors discuss the production function methodology rather thoroughly. Perhaps their principle contribution in this area is an extensive overview of the production function literature in education. Of particular usefulness is an appendix that individually summarizes the methodologies, variables used, and findings of much of this literature.

Benson, C. S. Education Finance in the Coming Decade. Bloomington, IN: Phi Delta Kappa, Inc., 1975.

Benson begins his book by briefly illustrating the sources of school funding, the extent of school expenditure disparities, and available measures of education outcomes. He then presents three major themes. The first is a discussion of family choice in selecting the level and quality of educational services. He discusses the principle of "voting with ones feet" and theorizes on the potential impact of educational vouchers on family choice.

The second theme is whether and how various educational resources can be more efficiently combined to increase school output. Under this heading, Benson discusses whether the level of school revenues can affect the quality of education and whether educators can determine how much money is necessary to run the public schools.

Third, Benson surveys the primary issues in school finance. He writes on the meaning of educational equity, the impact of the courts on educational funding, and the possible effect of two reform alternatives, district power equalizing and full state funding, on the distribution of school dollars.

Berke, J. S., Campbell, A. K. and Goettel, R. J. (eds.). Financing Equal Educational Opportunity. Berkeley, CA: McCutchan Publishing Corporation, 1972.

The articles in this book were developed to assist the New York State Commission on the Quality, Cost, and Financing of Elementary and Secondary Education (the "Fleischmann Commission") in developing new approaches to school finance in the state. Berke begins the book with an overview of the major issues in school finance. Other chapters address the particular sources of inequalities in New York State funding mechanisms, potential school finance programs in the state and a simulation of the impact of such reforms, the possible effect of a regional approach to school funding on revenue disparities, the potential impact of full state assumption on existing inequalities, the degree of funding inequalities in urban school districts, and a methodology to measure the match between educational revenues and the level of need in individual school districts.

Blaug, M. Economics of Education: A Selected Annotated Bibliography. New York, NY: Pergamon Press, 1978.

This is the third edition of a critical annotated bibliography of literature on the economics of education. The bibliography is largely confined to published literature (in English, French, and German) with the exception of certain mimeographed papers which can be obtained from various international agencies and institutions on request.

Blaug classifies the literature under five major chapters and according to two basic distinctions, developed and undeveloped countries. The chapters and subheadings pertaining to developed countries are:

- General Surveys
- The Economic Contribution to Education
    - Earlier Views
    - The Production Function Approach
    - Human Capital Formation
    - Measurement of Return
- The Economic Financing of Education
    - Higher Education
    - Public and Private Finance
    - Productivity and Efficiency
    - Technical and Vocational Education

The author notes that the classification scheme is somewhat arbitrary and cross-references are provided for items which could be classified under multiple headings. A chronological rather than an alphabetical listing is adopted in order to demonstrate the development of the subject over the years. There is an alphabetical index of authors for easy reference.

The author introduces each chapter with a brief summary and critique of the works listed, along with a commentary on the state of the art of literature in that particular topic area. In his overview of the body of literature on the economics of education, Blaug notes that the literature has been growing at an accelerated rate since 1950. Since new material is continuously appearing, it is the author's intention to keep the bibliography up-to-date through further editions.

Burkhead, J., Fox, T. and Holland, J. Input and Output in Large City High Schools. Syracuse, NY: Syracuse University Press, 1967.

This book reports the research findings on the education production functions for schools in Chicago, Atlanta, and the Project Talent data base. In their analysis, Burkhead, Fox, and Holland measured educational output as achievement test results, I.Q. scores, dropout rates, and intent to attend college. The independent variables included various educational and non-educational inputs. A regression analysis was run separately for each grouping of schools. The authors generally found that both school and non-school variables do affect educational output. However, the identification of significant input variables and the level of association between inputs and outputs vary between samples and output measures.

Cohn, E. Economics of State Aid to Education. Lexington, MA: D. C. Heath and Company, 1974.

Cohn's book has two principal components. The first discusses the history and technology of state aid to education. In this section, the author describes the origins of our present practices of school finance and discusses the role of early influential school finance scholars such as Cubberly, Strayer and Haig, Mort, Updegraff, and Morrison. He also writes on the varying definitions of educational equality and presents a thorough review of the alternative formulas used by states to fund education.

The second component is an empirical analysis measuring the impact of state aid on school size, per pupil expenditures, enrollment rates in nonpublic schools, per pupil bond issues, and per pupil local revenues. Cohn performs his analysis on both interstate and intrastate levels. Among his conclusions are that state aid tends to increase the total level of school expenditures but decrease the amount of local expenditures; is negatively related to nonpublic enrollments, local revenue, and bond sales; and is positively related to average school size. Cohn follows this empirical analysis by suggesting reforms that can potentially increase the efficiency of school expenditures.

Coleman, J. S., et al. Equality of Educational Opportunity. Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1966.

Commonly referred to as the Coleman Report, this research is the most well known and widely cited of the input-output studies in education. Coleman and his colleagues measured the impact of a pupil's social environment and his/her educational training on student performance. They concluded that "schools bring little influence to bear upon a child's achievement that is independent of his background and general social context."

Coleman's findings on the lack of influence of the schools on output have been harshly criticized on methodological grounds. To reach these conclusions, Coleman employed multiple regression analysis entering variable clusters in a predetermined order. Socioeconomic status variables were consistently entered into the equation first, followed by school variables. Due to a high intercorrelation between many of Coleman's independent variables, the order in which the variables were entered into the regression may have biased the findings. Whatever variance in the dependent variables that was explained by the intercorrelated independent variables was attributed to the first cluster of variables, in this case the socioeconomic variables. The impact of the school variables was likely severely underestimated. Even with this bias, several school variables were found to be significantly related to pupil performance. The highest explanatory effect among school variables was the verbal ability of teachers.

Garms, W. I., Guthrie, J. W. and Pierce, L. C. School Finance: The Economics and Politics of Public Education. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1978.

This is a comprehensive overview of school finance and the economics of education on the elementary, secondary, and postsecondary levels. Among the themes discussed are how to combine educational resources to maximize efficiency, the equality of the distribution of educational benefits, the impact of various school aid formulas, and the application of economic theories and methodologies to education.

More specifically, this text discusses such issues as:

- The potential tradeoffs between the educational policy goals of equality, efficiency, and liberty.
- The role of local, state, and federal governments in education.
- The relationship between school organization and educational finance.
- The impact of collective bargaining on educational finance and governance.
- The characteristics of the taxes used to fund education.
- The goals of federal education policy.
- The status of state funding schemes.
- The impact of the Serrano case on school finance reform.
- Problems in increasing school productivity.
- School district management and budgeting procedures.
- The technology of school finance reform.
- The role of citizens in school finance reform.
- The management of capital.
- The impact of school finance on urban schools.
- The financing of higher education.

Grubb, W. N. and Michelson, S. States and Schools. Lexington, MA: D. C. Heath and Company, 1974.

Grubb and Michelson present a thorough overview of the history, definition, and technology of educational equality. In the process, they describe the status of educational equality in the states and how the structure of state aid has contributed to that status. The authors follow up this theoretical discussion with an empirical model of intrastate public school finance.

Katzman, M. T. "Distribution and Production in a Big City Elementary System." Yale Economic Essays 8 (Spring 1968): 201-256.

In this article, Katzman estimated production functions for 56 schools in Boston. Among his output variables were three measures of school holding power. Holding power is usually defined as the inverse of the dropout rate. Katzman measured it as the percentage of students registering at the beginning of the academic year who remain through the year, average daily attendance as a percentage of average daily membership, and the dropout rate of elementary school alumni. He also measured pupil performance by second and sixth grade reading scores and the percentage of students passing the entrance exam for the prestigious Latin School.

Katzman entered the following input variables in his production function: class size, percentage of students in crowded classrooms, student/staff ratio, number of students in the school district, percentage of teachers with permanent status, percentage of teachers with masters degrees, percentage of teachers with one to ten years experience, percentage of annual teacher turnover, and an index of cultural advantage. The creation of a cultural advantage index is one way to overcome multicollinearity among various socioeconomic variables.

Katzman found that the index of cultural advantage, size of the school district, teacher experience, and student/staff ratio all affect educational output in at least one equation. However, none of the variables were significant in all output equations.

McLure, W. P. Special Programs in Public Schools: Administrative and Financial Structures. Urbana-Champaign, IL: University of Illinois at Urbana-Champaign, Bureau of Educational Research, 1976.

McLure and his staff examine the administrative and financial structures of special education programs in Illinois. Included in the analysis are vocational education and bilingual education programs as well as more traditionally defined special education services such as those for learning disabled or handicapped children. This discussion of the finance and governance of special education programs in Illinois provides good background on the issues and problems faced in many states. McLure concludes with a presentation of recommendations to improve further the finance and governance systems in Illinois.

Pincus, J. (ed.). School Finance in Transition. Cambridge, MA: Ballinger Publishing Company, 1974.

Pincus has compiled and edited a series of articles by school finance scholars on a diversity of funding issues. The book contains chapters on:

- Alternatives to existing funding mechanisms.
- The impact of the courts on school finance.
- The influence of school finance reform on tax policy.
- Effects of school resources on educational outcomes.
- The politics of school finance.
- The influence of school finance problems on broader social issues.

Reischauer, R. D. and Hartman, R. W. Reforming School Finance. Washington, DC: The Brookings Institution, 1973.

Reischauer and Hartman's book is a classic textbook treatment of the primary issues in school finance. The authors first describe the causes of the fiscal dilemma in funding education. They attribute the crisis partially to the rapid rate of expenditure increase since 1960 that was prompted by increased enrollment and rising prices. A second determinant was the inability to squeeze increased dollars out of traditional revenue raising structures. School funding relies heavily on the local property tax. Many citizens felt this tax was regressive and already too high, and therefore, refused to vote for increased spending in school budget referendums.

The authors also present data on the extent of revenue and expenditure disparities between states and school districts. They discuss mechanisms to reduce these disparities such as larger state equalization programs, full state financing, capacity equalization, and federal intervention. They also explain, in a separate chapter, the fiscal and enrollment problems that face non-public schools.

Ross, J. P. and Burkhead, J. Productivity in the Local Government Sector. Lexington, MA: D. C. Heath and Company, 1974.

In this book, Ross and Burkhead explain the definition and measurement of public sector productivity. They discuss the difficulties in relating quantities of inputs to the level and quantity of output of public services. They also explain the impact of alternative definitions of productivity on measures of the efficiency of production, survey various methodological approaches to the measurement of productivity, and review examples in the literature that attempt to measure productivity. Although the presentation does not focus on educational production per se, it is highly relevant to this area, and does apply many of the theoretical issues to the measurement of educational productivity.

The authors also develop a methodology for analyzing changes in government expenditures. This methodology is applied to four service areas: education, welfare, police, and fire. The data utilized are from New York State.

Sacks, S. City Schools/Suburban Schools: A History of Fiscal Conflict. Syracuse, NY: Syracuse University Press, 1972.

Sacks presents many of the important issues in school finance while building a model to determine the determinants of per pupil current educational expenditures. The determinant (independent) variables in the model are per capita income, the proportion of the population attending public schools (enrollment ratio), and the level of state elementary and secondary school aid. Sacks performs his analysis for urban school districts and suburban districts to assess the degree of the bias against cities in school finance. Among Sacks' findings are:

- Differences in average income between urban and suburban communities are a determinant of disparities in per pupil expenditures.
- The level of state aid affects the overall level of expenditures within a state.
- The relationship between the proportion of a district's children attending public schools and per pupil expenditures is negative.
- State aid is additive and not substitutive, but does tend to reduce local effort.

Cost-Benefit and Education Evaluation Theories

Cardus, D., Fuhrer, M. J., Thrall, R. M., et al. A Benefit-Cost Approach to the Prioritization of Rehabilitative Research. Houston, TX: Baylor College of Medicine, The Institute for Rehabilitation and Research, 1980.

This work represents the findings of a research effort begun in 1971 with the purpose of constructing "a mathematical evaluation model that would take into account both the monetary and non-monetary benefits of rehabilitative research." As a result, Cardus, Fuhrer, and Thrall have developed a model with aspects which are directly relevant to a cost-benefit analysis of vocational education.

Cardus, Fuhrer, and Thrall propose a multidimensional model, measuring groupings of costs and benefits along unique dimensions. For example, the monetary benefits resulting from vocational education would be measured along one dimension while nonpecuniary benefits could be measured on a different scale along a unique dimension. These different measures would be summed as a function of a group of parameters determined by the policy maker.

The report has chapters on operationalizing the terms of the proposed cost-benefit model and implementation of the model. A chapter is also provided detailing a systematic process to weigh the various benefit dimensions. The report ends with two appendices. One details the process used to cluster benefits while the other appendix provides an excellent discussion on the appropriate methodological approaches to relate costs and benefits.

Darcy, R. L. Some Key Outcomes of Vocational Education: A Report on Evaluation Criteria, Standards, and Procedures. Columbus, OH: Ohio State University, The National Center for Research in Vocational Education, 1980.

This study discusses the use of outcomes as a measurement tool in evaluating vocational programs. The focus is upon fifteen outcomes and their feasibility as evaluation criteria. These outcomes were rated by a small sample of people familiar with program evaluation and vocational education as to their importance and feasibility. These ratings are included in the study.

The final section reports the findings of a pilot test of one program evaluation outcome (reducing the risk of unemployment for minority youth) based on data from two states with large minority populations. While the author describes available data sources for outcome evaluation, the pilot test documented the problems associated with identifying data on minority youth with vocational training. The research indicates that data limitations may confront vocational evaluators regardless of the outcome measure utilized.

Davie, B. F. "Benefit/Cost Analysis of Vocational Education: A Survey." Occupational Education--Planning and Programming. Volume Two. A. Kotz, ed. Menlo Park, CA: Stanford Research Institute, 1967.

General considerations in benefit-cost analysis of vocational education are presented in this work. Included are detailed lists of the potential costs and benefits of vocational education and a discussion of three criteria for making benefit-cost decisions: (1) present value of net benefits, (2) rate of return, and (3) benefit-cost ratio. Davie suggests that the benefit-cost ratio is superior to the other measures. He also discusses the merits of cost-effectiveness analysis and explains one potential use of this methodology.

Davie makes the following general conclusions about cost-benefit analysis. He believes it is not sufficient in cost-benefit analyses to address the question, "Should a program be continued or discontinued?" Rather, one must ask, "Should the resources devoted to this program be diverted instead to a specific alternative (in order to produce a more useful result)?" Second, he contends that if the societal benefits associated with a particular vocational education program are significant but the monetary rewards to individual participants are slight, stipends should be offered to encourage enrollment in vocational programs.

Davie also reviews three early cost-benefit analyses. These are Eninger (1967), Corazzini (1966), and Carroll and Ihnen (1966).

Dorfman, R. (ed.). Measuring Benefits of Government Investments. Washington, DC: The Brookings Institution, 1965.

This collection provides evaluative papers on seven types of government projects. The authors of these papers are Gary Fromm, Herbert E. Klarman, Ruth P. Mack and Sumner Myers, Herbert Mohring, Jerome Rothenberg, Frederic M. Scherer, and Burton A. Weisbrod. Dorfman prefaces these articles with a brief discussion of cost-benefit methodology.

Of particular relevance is the article "Preventing High School Dropouts" by Weisbrod. Weisbrod utilizes cost-benefit analysis to evaluate a dropout prevention program. Aggregated data concerning income differentials between non-college bound high school graduates and high school dropouts are applied to a specific case study conducted in St. Louis, Illinois. Non-pecuniary components are incorporated into the analysis as biases, although no absolute monetary value is assigned. Weisbrod concludes that in at least this case study, monetary costs far exceed benefits. This selection also includes an excellent discussion on discount rate measures, an insightful rebuttal by Herman P. Miller, and Weisbrod's reply.

Hale, J. A., Starnes, P. M. and Mickler, W. A. The Development and Testing of a Model for Determining the Costs of Vocational Education Programs and Courses (Final Report). Gainesville, FL: University of Florida, Institute for Educational Finance, 1977.

This study was designed to develop and field test an "added cost" model for calculating vocational program costs per full-time equivalent student. Hale emphasized the difficulty in cost determination because of discrepancies in data format. He noted, however, that the overall quality of pupil and fiscal accounting data is improving.

Program data, student accounting data, and fiscal accounting data were compiled to determine the added-cost relationship of vocational education programs. Among the conclusions were that:

- Vocational courses should pay closer attention to Department of Labor Occupation codes and the Office of Education vocational course numbering scheme.
- A "basic" program needs to be commonly defined.
- Discrepancies in student accounting methods used by secondary and postsecondary institutions do not allow for interorganizational comparisons.
- Student contact hours is the best student accounting method.
- Better data bases for fiscal accounting seem to exist at the postsecondary level.
- Objects-of-expenditures provide the common basic structure for relating expenditures to courses and program areas.

The study also includes a User Manual containing the data forms, user instructions, a course cost algorithm, sample data classifications, definitions and their sources, and a suggested data processing coding structure.

Hu, T. and Stromsdorfer, E. W. "Cost-Benefit Analysis of Vocational Education." Handbook of Vocational Education Evaluation. C. K. Tittle and L. Cohen, eds. Beverly Hills, CA: Sage Publications, Inc., 1979.

Hu and Stromsdorfer present a concise overview of the methodological and measurement difficulties in performing a cost-benefit analysis of vocational education in this work. The presentation is divided into separate discussions of the problems of measurement on the cost side and the benefit side.

On the cost side these problems include the distinction between educational expenditure and educational cost, joint costs, current costs, and capital costs. The problems in benefit measurement that are treated include wages versus earnings, noneconomic benefits, and transfer payments.

The authors also discuss a number of empirical studies estimating the costs and benefits of vocational education. They conclude that these studies have suffered from the inadequate availability of data and the inability to successfully measure non-economic benefits and costs of vocational education.

Kaufman, J. J. Cost-Effectiveness Analysis as a Method for the Evaluation of Vocational and Technical Education. Washington, DC: Department of Health, Education, and Welfare, Office of Education, 1968.

This paper discusses cost-benefit analysis in terms of: (1) logic and meaning, (2) some of the misconceptions which prevail concerning this method of evaluation, (3) some of the problems and limitations of this method, and (4) the conclusions of one study which attempted to determine whether or not there is a pay-off from an investment in vocational and technical education.

In the discussion of the logic and meaning of cost-benefit analysis, the methodology is described as an attempt to establish the equivalent of a system of market principles for various types of government activities. Kaufman makes the important point that one should not talk about education in terms of cost or needs alone. No cost can be justified without a reference to pay-off; and the satisfaction of any need cannot be justified without reference to cost. He continues that since decisions must be made as to the allocation of resources among competing educational programs, cost-benefit analysis is an appropriate method for making these choices. It tends to force administrators to think through their objectives, to concentrate on costs, and to think in terms of alternatives.

A number of what Kaufman describes as misconceptions about cost-benefit analysis are presented. These include statements such as (1) cost-benefit analysis is merely a subterfuge for seeking to conduct education on a "least-cost" basis; (2) since benefits are measured only in dollar terms, this is a form of crass materialism; (3) because cost-benefit analysis measures pecuniary benefits, program objectives with nonquantifiable results cannot be justified by cost-benefit study; (4) cost-benefit technique has not been fully developed and therefore should not be applied; and (5) cost-benefit analysis appears to ignore political considerations.

Kaufman also discusses the meaning of and problems in educational evaluation. He writes that measurement is a necessary part of evaluation, but evaluation requires both premeasurement and postmeasurement considerations. Before measurement commences, evaluation requires the formulation of a basic educational philosophy (and its attendant goals) and the statement of specific behavioral objectives to be measured. After measurement is completed, evaluation requires: (1) the analysis of measured quantities in terms of the attainment of objectives and progress toward goals; (2) an estimate of the value of existing programs in determining this progress; and (3) an estimate of the costs involved in conducting these programs.

The two paths to greater acceptance of evaluation are: (1) to assure the school administrator that the evaluation is to be used to study the process of education within the school and to help him/her improve this process, and not for the purpose of making value judgments about the school; and (2) to follow up this assurnace by utilizing evaluation procedures which are aimed at collecting only those data relevant to the educational process.

Kaufman includes a discussion of the findings of his Pennsylvania study as an example of cost-benefit research, In the study he found that vocational-technical graduates earned significantly more and were employed significantly longer than the graduates of the other curricula during a six-year post-graduate period. It was assumed that earnings and employment are appropriate indices of the benefits of education.

Kim, J. E. *A Cost-Effectiveness/Benefit Analysis Model of Postsecondary Vocational Programs* (Technical Report). Bloomington, IN: Indiana University, Department of Vocational Education, 1977.

This technical report presents a cost-effectiveness/benefit analysis model for post-secondary vocational programs which was developed for the Indiana State Board of Vocational and Technical Education. Kim defined cost-effectiveness/benefit analysis as a technique for assessing the outputs of existing and/or new programs in relation to their specified program target goals and against the associated costs. The specific project objectives were: (1) to conceptualize cost-effectiveness/benefit analysis; (2) to develop a conceptual model, data forms, and a standard procedure for using this model; (3) to evaluate the model and data forms; and (4) to produce an administrator's manual.

A tri-dimensional structure was conceptualized for vocational program evaluation. The structure consisted of: (1) program classification by degree level; (2) the criteria of effectiveness, efficiency and performance; and (3) a time frame for one-year completion, two-year graduation, and follow-up survey.

A cost-effectiveness/benefit model was developed within the input-output framework. Social demand, support, and student characteristics were considered as inputs to the school system, and monetary and non-monetary benefits for society were viewed as long-term outcomes of the educational system. Four major components of the model were specified by: (1) program classification; (2) program objectives; (3) program outputs; and (4) program costs.

The model was designed to generate three kinds of cost-effectiveness/benefit measures: (1) program effectiveness; (2) cost-efficiency; and (3) a cost-effectiveness and performance ratio. Fifteen formulas were presented to compute these measures. Target goal statements were developed to include five objectives: (1) enrollment; (2) career preparation; (3) placement and employment; (4) advanced studies; and (5) economic benefits. The two data forms developed in accordance with the program objectives were: (1) a data form designed to determine program goals and outputs pertaining to enrollment, career preparation, job placement, advanced studies, and long-term benefits; and (2) a simplified data form for analyzing and computing direct and indirect program costs.

Kim, J. E. and Harris, R. C. A Cost-Effectiveness Analysis Model for Secondary Vocational Programs (Technical Report). Bloomington, IN: Indiana University, Department of Vocational Education, 1976.

This paper presents a conceptual model to analyze the cost-effectiveness of secondary vocational programs focusing upon program effectiveness, cost efficiency, and management performance. The model consists of four components: vocational program classification; program objectives; program outputs; and program costs. It generates three kinds of cost-effectiveness measures: program effectiveness, cost efficiency, and cost-effectiveness and/or performance ratio. The authors identify eight elements for analysis and base the model upon these elements. They also distinguish cost-benefit analysis from the cost-effectiveness concept.

Levin, H. M. "Cost-Effectiveness Analysis in Evaluation Research." Handbook of Evaluation Research. M. Guttentag and E. L. Struening, eds. Beverly Hills, CA: Sage Publications, 1975.

This paper discusses cost-effectiveness analysis in evaluation research and focuses upon its application to social programs and policies. The author presents a rationale for utilizing cost-effectiveness methodologies and compares them to cost-benefit and cost-utility analyses. He then discusses the cost-effectiveness technique in detail examining both its conceptual nature and the methodology of assessing the costs of alternatives and of measuring effectiveness. Levin cites a number of studies that used either cost-benefit or cost-effectiveness techniques.

He concludes that the cost-effectiveness technique is a potent source of information. However, its results need to be combined with other factors in order to make rational policy decisions.

Mohrenweiser, G., et al. Planning Design for Conducting a National Survey of the Differential Cost of Vocational Education. Minneapolis, MN: Educational Management Services, Inc., 1979.

The objectives for this project were (1) to design a national survey utilizing the Institute of Educational Finance differential cost model of costing secondary and postsecondary vocational educational programs, and (2) to modify the model to allow for separation of the costs associated with educating the handicapped from basic education costs. The project determined in a field test that the model adequately calculated differential costs of vocational education at the subprogram level.

National Institute of Education. The Vocational Education Study: The Interim Report. Washington, DC: U.S. Government Printing Office, 1980.

This report discusses the effects of the changes in Federal vocational education legislation adopted in 1976 upon the distribution of Federal funds and the planning and evaluation of vocational education programs by the states. It also describes the results of research on the effects of participating in vocational education programs and surveys selected features of public school vocational education. In addition, the report examines the various effects of vocational education upon program participants. All of these issues are themes in this ongoing research effort that was mandated by the Education Amendments of 1976 (P.L. 94-482).

Prest, A. R. and Turvey, R. "Cost-Benefit Analysis: A Survey." The Economic Journal 75 (December 1965): 683-735.

Prest and Turvey define cost-benefit analysis as a technique for determining which public investment projects will have the greatest net benefits for society as a whole. This article provides a discussion of the general principles of the methodology followed by examples of how cost-benefit analysis could be applied to the evaluation of several types of public investment projects. The application of cost-benefit analysis to evaluate public education is one of the examples used.

Prest and Turvey equate the benefits of a particular project to what people would be willing to pay for them if an effective market for the goods or services existed. Costs are equal to the present value of consumption foregone in order to finance the project. Translating this theory into practice, however, is problematic. For example, calculating the present value of consumption foregone in order to finance the project is sometimes complicated by the fact that what is foregone may not be just present consumption. If the project in question would take funds away from other investment projects which would have provided other goods and services in the future, then the present value of those goods and services represents a part of the cost of undertaking the public investment project.

Prest and Turvey correctly assert that cost-benefit analysis may be of limited use for evaluating projects that are national in impact since these projects are likely to alter the universe of prices. Costs and benefits are calculated assuming that prices remain constant. If the project being studied causes prices to change, conclusions about its net benefits could be misleading.

Problems in measuring the benefits of investment in education are also discussed in this review. Increased income is a positive benefit to society to the extent that it represents an increase in productivity. However, Prest and Turvey question the actual correlation of earnings and marginal productivity (or marginal value to society). Also, they note the problem of using cross-sectional data to predict income into the future. However, Prest and Turvey suggest that even though cost-benefit analysis of public projects involves making subjective estimates of the dollar value of the project's benefits, especially for non-pecuniary benefits, such an analysis is superior to solely relying on vague qualitative judgments of a project's worth.

Reinhart, B. and Blomgren, H. Cost Benefit Analysis--Trade and Technical Education (Final Report). Los Angeles, CA: University of California, Division of Vocational Education, 1969.

This report contains introductory material on cost-benefit analysis, a review of two cost-benefit studies of vocational education, and a discussion of two basic approaches to cost-benefit analysis of vocational education. A proposal for a cost-benefit study of high school and junior college vocational education follows the general text. Among the theoretical components of cost-benefit analysis discussed are joint costs (when a vocational program shares facilities with an academic program, the authors conclude that it is not necessary to sort out how much of the value of that facility should count as a vocational education cost), and capital costs (the authors include a formula which explains how to count the cost of capital equipment which will outlast the program being studied).

Reinhart and Blomgren write that there are two broad categories of cost-benefit studies in vocational education: (1) vocational versus academic education, and (2) vocational versus vocational education. Most analyses of vocational education have so far been of the first type. In this approach it is assumed that vocational and academic education are different means of achieving the same ends. This erroneous assumption may cause misleading results. It is proposed that studies of the second type be conducted instead in which the levels of cost-effectiveness of various vocational education programs may be compared.

Rothenberg, J. "Cost-Benefit Analysis: A Methodological Exposition." Handbook of Evaluation Research. M. Guttentag and E. L. Struening, eds. Beverly Hills, CA: Sage Publications, 1975.

This paper examines the methodological considerations in cost-benefit analysis. The author also presents applications of cost-benefit designs to suggest the scope of issues encountered.

Included in the discussion are such issues as the structure of social evaluation; the structure and scope of cost-benefit analysis in terms of ends, means, and scarcity; individual, group, and social evaluation; the value context of cost-benefit analysis; the meanings and benefits of costs, income level, and income distribution; issues in measuring benefits and costs; and examples of applications.

Rothenberg concludes that cost-benefit analysis is an attractive method for certain situations. However, he also raises concerns about its practical usefulness when there is a serious inadequacy of relevant data.

Smith, R. E., "The Opportunity Cost of Participating in a Training Program." Journal of Human Resources 6 (Fall 1971): 510-519.

This paper presents an analytical model to estimate the foregone income of students in a manpower training program. The model is applied to institutional training under the Manpower Development and Training Act (MDTA).

The author believes that estimating foregone earnings of trainees is the weakest component of most economic analyses of manpower programs, yet none of the methodological studies reported in the literature have focused specifically on this problem. The assumption implicit in most studies is that current employment status is an unbiased estimate of subsequent status. Smith contends that this is valid only if entrance into the program is unrelated to economic status, an assumption that is not likely to be true.

To estimate the proportion of the trainee group that would have been employed in each of the months of training (or the probability that any particular trainee would have been employed), the author assumes the condition of a first-order Markov chain process.

To estimate the trainees' foregone earnings, Smith calculates their likelihood of being employeed, given their demographic characteristics, education, labor market handicaps, and the overall level of unemployment in the region. Using a Markov process, each trainees' likelihood of employment is in this way estimated for each month of the training program. These employment rates are combined with a rough estimate of the average rate of the appropriate comparison groups to compute an estimate of total foregone earnings.

In an application of the model on a select group of MDTA institutional trainees, the average foregone earnings was estimated at $1,280, considerably greater than generally assumed. Smith discusses two policy issues that were raised by his findings. First, to the extent that the earnings loss is not offset by gains of non-trainees, the immediate loss to the economy is greater than asserted in most evaluations, suggesting a lower benefit-cost or effectiveness-cost ratio for the training programs. Second, the redistributional impact of manpower programs may not conform with the intent of the legislation.

Beginning in fiscal 1967, one explicit objective of MDTA training has been to aid the competitively disadvantaged in the labor market. The estimates of the foregone earnings of trainees made by the study suggest that, in the short run, the trainees themselves are bearing a large portion of the training costs, even after receipt of training stipends. If the trainees are persons to whom society wishes to transfer purchasing power in the current period and increase the expected value of their future earnings, the training stipends or other transfers would need to at least balance their immediate earnings losses.

Stromsdorfer, E. W. "Economic Concepts and Criteria for Investment in Vocational Education." Occupational Education--Planning and Programming. Volume Two. A. Kotz, ed. Menlo Park, CA: Stanford Research Institute, 1967.

Stromsdorfer reviews various techniques in, and components of, cost-benefit analysis of vocational education. He includes a particularly interesting discussion of the potential problem of double-counting educational benefits. By way of example, Stromsdorfer explains that the counting of certain intangible benefits of vocational education, such as increased mobility or labor force discipline, may be redundant if they are already reflected in increased earnings. Similarly, to consider the extra income tax revenue generated by vocational graduates would be double-counting since this revenue comes from their gross earnings which already is probably included in the cost-benefit model. Reduction in welfare benefits is not calculated as a net benefit to society since it merely transfers funds from one group to another.

Stromsdorfer also makes the following conclusions:

- It is possible that rather than reducing aggregate unemployment, vocational education actually displaces untrained workers with those who have received vocational training. This displacement would have to be figured into the costs of vocational education.
- Spending public money on vocational education may constitute an indirect subsidy to industry. Since it expands the supply of skilled labor, vocational education allows firms to pay wages that are lower than they would otherwise have to pay, thereby increasing profits and/or reducing output prices.

He also discusses the trade-offs between the present value of net benefits and internal rate of return criteria and circumstances under which any cost-benefit criteria may be inappropriate.

Cost-Benefit Applications in Vocational Education

Carroll, A. B. and Ihnen, L. A. Costs and Returns of Technical Education: A Pilot Study. Raleigh, NC: North Carolina State University, 1966.

In this paper, Carroll and Ihnen present a relatively comprehensive analysis of the costs and benefits resulting from two years of postsecondary schooling. The study is based on information concerning 45 graduates of Gaston Technical Institute, North Carolina, and their high school peers of similar academic performance who did not continue formal education after high school.

Incomes of individuals may be affected by many factors other than formal schooling. Carroll and Ihnen employed regression analysis to determine the portion of observed earnings differential that was attributable to technical training. Individual earnings per month was regressed on a dummy variable for technical schooling, high school grade average, age-experience, mother's education, residence during high school, military experience, migration from home community, size of high school class, and two trend variables. All the coefficients were significant. Technical schooling was estimated to increase earnings by $38.98 per month.

Cost estimates consisted of: (1) costs for books and student supplies; (2) school facilities, supplies, and personnel; and (3) loss of production by students while enrolled in school. In probably the weakest methodological step of the paper, estimates of future earnings differentials were based on differences exhibited in cross-sectional data of individuals who had completed only high school and those with one to three years of college experience. The report also attempted to estimate a partial evaluation of the additional fringe benefits typically enjoyed by individuals with technical educations.

In this report, Carroll and Ihnen reconcile the costs and benefits of technical schooling by both the rate of return and discounted present value methods. Private and social rates of return are evaluated. The report also includes a discussion of appropriate discount rates. Carroll and Ihnen concluded by asserting that high rates of return exist for investment in postsecondary technical schooling.

Conroy, W. G. Jr. and Diamond, D. E. The Impact of Secondary School Occupational Education in Massachusetts. Lowell, MA: The University of Lowell, 1976.

This is a study of the impact of vocational education on workers' earnings in Massachusetts. A random sample of 2,600 vocational-technical and general academic program graduates was the subject of study. The authors found that male vocational school graduates had an average annual salary that was $1,378 higher and found jobs an average of four months sooner than male general academic program graduates. Female vocational program graduates did not generally earn more than female general academic graduates.

The authors also make various conclusions about the characteristics of Massachusetts' vocational population. Vocational school students were of lower socioeconomic status, scored lower on scholastic aptitude measures, evaluated high school as a more positive experience, and received more help from their schools in finding jobs than did academic students.

Corazzini, A. J. Vocational Education: A Study of Benefits and Costs. Princeton, NJ: Princeton University, 1966.

Corazzini's study is one of the earliest cost-benefit analyses in vocational education. Its findings question the efficiency of investment in vocational education. This report summarizes a study of the costs and benefits of public vocational education in Worcester, Massachusetts. Differences between regular and vocational education were calculated with respect to their public direct costs (current account items such as teacher salaries), public implicit costs (such as what the city would earn if it rented out the school building and equipment), and direct private costs (costs incurred by students for books and supplies). Measurement of the cost differential between regular and vocational education was simplified since Worcester has separate institutions for these two types of education.

In a series of sub-studies, Corazzini also examined the impact of vocational education on student benefits measured as an increase in lifetime earnings, increase in intergenerational mobility, and increase in geographic mobility. In one sub-study, the starting wages of high school graduates in selected local firms were compared. The differential between the wages of graduates from regular high school programs and those of graduates from vocational high school programs was determined. Corazzini then calculated the number of years this wage differential must be maintained in order for vocational education to justify its extra costs. He found that after a few years of experience, workers' wages do not generally depend on whether they attended regular or vocational high schools. Assuming that the vocational high school graduates at these firms would have gone to a regular high school had the vocational program been unavailable, Corazzini concludes that by this measure the costs exceed the benefits.

Another sub-study examines the benefits of vocational education under the assumption that its availability prevents some students from dropping out of school. By this measure, the benefit of vocational education is the difference between the lifetime expected income of a vocational high school graduate and that of a dropout. Corazzini concludes that if every vocational high school graduate would have dropped out had vocational education been unavailable, then the benefits of these vocational programs exceeded their costs. However, the impact of vocational education on dropout rates is not known.

Another sub-study followed the employment history of graduates from a girls vocational high school for 18 months after graduation. Research showed that their wages were very close to the Federal minimum wage. No attempt was made to determine whether graduates from this program were more successful in finding jobs than women who had graduated from the regular high school.

The benefit of intergenerational mobility was studied by comparing the type of job of vocational program graduates to those of their fathers. Over fifty-three percent of the vocational program graduates were white collar workers, but only 17.4 percent of the fathers were in this category. Corazzini concluded from this limited data that vocational education is probably responsible for enhancing intergenerational mobility. He also suggested that on the basis of where vocational program graduates accepted jobs, there was no evidence that vocational education had enhanced their levels of geographic mobility.

Doty, C. R., et al. Model for Calculating Cost per Pupil for Secondary Vocational, General, and Transfer Curricula in Comprehensive High Schools, Shared Time Vocational Schools (Final Report). New Brunswick, NJ: Rutgers University, Department of Vocational-Technical Education, 1976.

This study reports the findings of a two-stage investigation into the cost of education programs. The objectives of the first stage of the study were to review the literature, to identify and define financial cost variables, to develop, test, and revise a data collection model, and to report the findings.

The second stage involved refining the model; developing guidelines for local administrators to use the model; applying the model in a comprehensive high school, a full-time vocational school, and a shared time vocational school; and identifying the cost ratio among vocational, college preparatory, and general education programs.

A stratified random sample was utilized and data collected from four public schools in New Jersey. The authors conclude that the model developed can provide accurate costs per pupil per program or educational goal, although there are some limitations on its applicability to all types of schools.

Eninger, M. U. Effectiveness Evaluation Data for Major City Secondary Education Systems in the U.S. Pittsburgh, PA: Educational Systems Research Institute, 1972.

This article discusses the Manpower Conversion Equation which is a theoretical model designed to enable vocational education administrators to manage manpower development systems and to apply management tools to vocational education programs. The model states that supply should equal demand for skilled manpower. From this model, six vocational education objectives were generated by Eninger. Questionnaires were given to a sample of graduates from 449 secondary schools in 22 cities and analyzed by sex and race, type of program, and type of occupation. Ten problem areas were identified in the analysis: absence of the manpower conversion concept, absence of measurable vocational education objectives, inadequate vocational education supporting systems, undefined responsibility and accountability, inappropriate administrative organization for effective vocational education, inadequate relations with the employer community, inadequate relations with the community of parents, absence of vocational education operational research, inadequate involvement of vocational teacher personnel, and inadequate application of management concepts, principles, and techniques.

Galloway, L. E. and Ghazalah, I. A. The Role of Vocational Education in Improving Skills and Earning Capacity in the State of Ohio: A Cost-Benefit Study. Athens, OH: Ohio University, College of Business Administration, 1972.

The authors report the methods and findings of a benefit-cost analysis of 14 subject areas of vocational education in 18 high schools. Both private and social rates of return were calculated for each subject at each high school. The study employed two different comparison groups, high school dropouts and students enrolled in non-vocational programs.

The study utilized both monetary and non-monetary benefits. Monetary benefits were calculated as earnings. The non-monetary measures included job satisfaction, work attitude, communication skills, interpersonal relationships, and self-confidence. For most programs, the authors found favorable rates of return and recommended continued investment in secondary vocational education.

Hamby, J., Harper, R. and Myers, L. A Comparison Study of the Benefits of Secondary and Postsecondary Vocational Education. Portland, OR: Northwest Regional Education Laboratory, 1978.

This study examined the returns on investment of secondary and postsecondary vocational training curricula in Montana. The research is notable for its use of non-pecuniary educational benefits.

The population studied was 857 high school graduates of the classes of 1970 and 1971 who were between 23 and 25 years old at the time of the survey and who had been employed for at least two years since their graduation. Data were collected through telephone interviews, employer surveys, and mailout surveys. The focuses of the data collection were on the graduates' perceptions of their training, employers' perception of the training, and comparison of graduates' perceptions of quality of life. The population was divided into three groups based upon their training: (1) postsecondary vocational, (2) secondary vocational, and (3) academic/general.

Among the results, the authors found that postsecondary vocational graduates were more satisfied with their training and had attitudes employers seek in their employees, but had a tendency toward feelings of depression. Not surprisingly, academic/general graduates had high esteem for academic educational programs, while postsecondary and secondary vocational students had low esteem for these programs.

Harris, M. A. Benefit-Cost Comparison of Vocational Education Programs: Statewide Evaluation of Vocational-Technical Education in Florida. Tallahassee, FL: Florida State University, 1972.

This study was concerned with statewide benefits and costs of vocational education programs in Florida. The purposes of this study were fourfold:

- Develop a methodology for conducting a statewide benefit-cost study of vocational education programs in Florida.
- Examine, compare, and analyze the public and private benefit and cost aspects of four vocational education programs in Florida.
- Compare the public and private benefit and cost aspects of students who attend vocational education programs while enrolled in day high school and students not enrolled in day high school.
- Produce formulas which result in the development of a model for predicting public and private economic returns of vocational education programs.

The study included measures of both public and private vocational education costs and pecuniary and non-pecuniary benefits. Among the measures of non-pecuniary benefits were whether former vocational education students were employed and the degree to which students were employed in occupations related to their vocational education programs.

To account for the influence of regional price variations and regional labor market conditions and wage rates, the analysis divided the state into major geographic regions. Within each region, two institutions designated as area vocational centers were randomly selected. Based upon stated criteria, four vocational education programs were included in the study.

The differences between the net wage rates for skilled workers and the net wage rates for unskilled workers represented the net economic benefits resulting from vocational education programs. The annual benefits before Federal income tax deductions were considered public economic benefits since these earnings represented an increase in national income. Annual benefits after Federal income tax deductions were considered private economic benefits since these earnings represent an increase in personal disposable income. Since the relevance of the vocational training to employment skill requirements did not enter into the calculation of monetary benefits, a relatedness index was developed as a third measure of benefits.

In order to calculate the public cost of vocational education two factors were considered: (1) the quantity of time students spent in a vocational education program (hours of attendance); and (2) the value or cost per unit of time of the services received by individual students. The study included an analysis of nine categories of expenditures to obtain the dollar cost per full-time-equivalent student for each course.

Private indirect costs were measured as a function of two factors: (1) the quantity of time that a student spent in a given vocational education program; and (2) the value or price of time measured by earnings foregone.

Private direct costs used in the analysis included tuition, books, supplies, uniforms, special equipment, and transportation.

Linear equation models for projecting returns on investment in vocational education were developed. The findings included:

- Rates of return from investment in each of the four selected vocational education programs were positive and significant. These findings suggest that promotion and expansion of vocational education in Florida would be a wise economic investment.
- There were statistically significant differences in the rates of return on investment between different vocational programs. Harris believes varying rates of return are a justification for reallocation of resources among programs.
- There were statistically significant differences in rates of return on investment between secondary and postsecondary vocational education.
- On the average, student costs of vocational education are greater than public costs. In order to provide students with information necessary for allocating their resources, it is suggested that summaries of studies such as this be provided to students and guidance counselors.

Hu, T. Studies of the Cost-Efficiency and Cost-Effectiveness of Vocational Education. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1980.

Hu summarizes the major concepts in cost-efficiency and cost-effectiveness analysis and reviews the major findings of past research in these areas. He defines cost-efficiency studies as those involved with determining the optimal distribution of inputs in order to minimize costs. Cost-effectiveness analysis, which is used interchangeably with cost-benefit analysis, examines the relationship between program costs and outcomes.

Among the technical concepts briefly presented are expenditures versus costs, average versus marginal costs, joint costs, opportunity costs, wages versus earnings, non-economic benefits, discount rates, and transfer payments. However, the major contribution of this paper is the review of existing cost-efficiency and cost-effectiveness analyses, primarily those performed after 1970.

Hu, T., Lee, M. L., Stromsdorfer, E. W. and Kaufman, J. J. A Cost-Effectiveness Study of Vocational Education. University Park, PA: Pennsylvnia State Univeristy, Institute for Research on Human Resources, 1969.

This study compares the costs of vocational and comprehensive secondary education, and the labor market performances of graduates of these schools who did not attend college. Measures of labor market performances are average monthly before-tax earnings for a six-year period following graduation and the percent of time employed during that same period. Earnings before taxes are considered a social benefit since the incremental increase in before-tax earnings which are due to the investment in vocational or comprehensive education represents an explicit measure of the monetary returns to society.

Data were obtained from the responses of 2,767 mail questionnaires sent in 1966 and 1967 to graduates of high schools in Philadelphia, Detroit, and Baltimore. Multiple regression analysis was used to measure the net effect of curriculum on the labor market performances for the two types of graduates while controlling for the effects of confounding variables such as socioeconomic characteristics.

In comparing the costs and returns of the two types of high school education, a cost analysis was first performed using the capital recovery factor. The authors assumed an average building life was 60 years and used social discount rates of six and ten percent. The total (capital and current) costs were related to average daily attendance (ADA). The difference in opportunity costs among vocational and comprehensive graduates while they were attending high school was assumed to be negligible.

Monetary returns for high school graduates were obtained through a regression analysis. Net present value, benefit-cost ratio, and rate of return were calculated for vocational and comprehensive education students.

The authors concluded that among students who do not attend college, the monetary returns of vocational graduates are higher than those of comprehensive high school graduates. The authors noted, however, that it is necessary to estimate earnings and employment equations separately on the basis of sex and race to obtain accurate distinctions. Also, the earnings differential may be disappearing as these graduates move along with lifetime earnings profiles. Nevertheless, investment in vocational education is economically efficient, if money costs and benefits are relatively complete indexes of total economic costs and benefits. Finally, the authors note that the study ignores all non-economic costs and benefits of the two types of secondary education, although it is recognized that these non-economic factors are important in any analysis of the total impact of education.

Ittner, F. E. Project to Develop a Cost-Benefit Model for Vocational Programs at College of Alameda (Final Report). Los Angeles, CA: University of California, Clearinghouse for Junior College Information, 1972.

This report describes a pilot study on the development of a cost-benefit model for vocational education programs at the postsecondary level. The model was applied to three vocational programs at the College of Alameda, California - Business Equipment Technology, Dental Assisting, and Diesel Mechanics. Data were gathered through a survey of the five graduating classes from 1968-1972.

A flexible model was designed so that it may be used to compare the relative effectiveness between programs within the same college or at different colleges. Costs were broken down by direct and indirect categories. Included in the cost calculation was the cost of classroom space and depreciation of equipment. Benefits were assumed to be the increased earnings of the vocational graduate as compared with his/her earnings before the schooling, or with the average earnings of his/her cohorts in the area served. These costs and benefits were categorized for the student, institution, and community.

An increase in income was calculated for the vocational graduates. However, this increase was quite small. The report points out however, that over a longer period of time graduate earnings may increase sharply. Ittner suggests that a careful analysis of the initial wages plus the wages earned after a period of time, turnover of jobs, and job satisfaction should be an important part of future analyses of the effectiveness of vocational programs.

Kaufman, J. and Lewis M. The Potential of Vocational Education: Observations and Conclusions. University Park, PA: The Pennsylvania State University, Institute for Research on Human Resources, 1968.

This report is a general discussion of vocational education through data obtained in studies of three cities in Pennsylvania. It focuses upon the extent of vocational programs in schools, the modification of these programs to meet student and employer needs, and the overall strengths and weaknesses of the programs. The study also obtained information on the vocational education graduate's evaluation of his/her training and experience in employment and raises the question of whether the extra costs of these programs produce sufficient benefits to maintain the programs. Data were collected from school records, census data, and supervisors' evaluations of graduates' job performance. The authors conclude that students need a more thorough orientation to vocational training than they currently receive in order to benefit from the vocational program and career options available.

Koch, J. V. A Benefit-Cost Analysis of Vocational-Occupational Training at Selected Illinois Junior Colleges. Springfield, IL: Illinois State Advisory Council on Vocational Education, 1972.

This report presents the findings of a cost-benefit analysis of vocational training at the junior college level in Illinois. Utilizing cross-sectional survey data collected from graduates of five junior colleges, Koch estimated that the private rate of return to the vocational student of technical training was 12.3 percent and the social rate of return was 8.9 percent.

Koch begins the report with a very brief overview of literature in the vocational evaluation field. Three studies are specifically reviewed: Hardin, Noscow, and Borus (1971), Gubins (1972), and Carroll and Ihnen (1966).

Koch then introduces eight issues which need be considered when performing a cost-benefit analysis. He comments that: (1) vocational-occupational training graduates would have earned certain incomes even if they had not obtained a degree; (2) a large proportion of the observed income differential between vocational training graduates and high school graduates may not be due to increased education but rather to greater motivation and ability; (3) individuals enter and leave the labor force periodically and therefore do not earn the income which is reported for their peers in some years; (4) some education and training is viewed by students as being a consumption expenditure rather than an investment expenditure; (5) large intergenerational effects and externalities may be caused by education and training which are not captured by income data; (6) increased incomes are vulnerable to increased tax payments; (7) many jobs have non-monetary aspects such as vacation time, insurance, and other benefits; and (8) cross-sectional data may result in misleading results. In light of these considerations, Koch modified (in a not entirely satisfactory manner) the typical rate of return formula.

Three types of cost were calculated and summed in the analysis to produce a total cost value. These cost components were: (1) direct costs paid by students; (2) direct costs paid by society (e.g. faculty salaries, equipment, etc.); and (3) income foregone by the students. Benefits were calculated as the difference between the income of the vocational graduate and the median income of non-vocational high school graduates. This value was then reduced by 25 percent to reflect differences in ability and motivation. Utilizing this methodology, Koch arrived at his estimated rates of return. The rate of return is greater for the vocational student than society as a whole because the direct costs of school incurred by society are not considered in the calculation of the vocational graduate's rate of return.

Marson, A. A., Weiner, A. E. and Sorenson, R. P. Cost-Benefit Model Development. Cost-Benefit Study (Final Report). Fond du Lac, WI: Lakeshore Technical Insitute and Moraine Park Technical Insitute, 1978.

This report details the findings of a three year study by the research departments at Moraine Park and Lakeshore Technical Institutes. The major emphasis of the report was to examine the non-monetary benefits of a vocational-technical adult education (VTAE) program.

Five vocational training programs were examined. School records were reviewed to obtain the cost of offering each program. Two similar survey forms were developed and sent to VTAE graduates from these five programs and a sample of academic high school graduates. Data from these two sources were analyzed to compare costs and benefits.

Costs and benefits were related by calculating the net present value, the benefit-cost ratio, the average rate of return, and the duration of the payback period. These calculations were performed for both the student and society as a whole.

The following conclusions were reached as a result of the analysis:

- From an economic viewpoint, the benefits of a vocational-technical education to society and to the students themselves are greater than the costs of offering the education to the student.
- VTAE students score higher on tests of study habits and attitudes than do high school students.
- There is a correlation between attitudes (study habits) and program success.
- Both high school graduates as well as VTAE graduates have positive attitudes toward education and toward employment as well as positive degrees of self-acceptance. Little evidence exists to show that a vocational-technical education per se has any effect on these three attitudes.
- Vocational-technical school graduates receive much more help from their school in finding a job than do high school graduates.
- More VTAE graduates are employed in a position they consider permanent within two years after their graduation than are high school graduates.
- Vocational-technical graduates enjoy more job satisfaction than do high school graduates.
- A vocational-technical education does affect the student's personal as well as family life. However, two-thirds of the graduates surveyed stated that they weren't greatly hampered in spending time with family and friends.

- A vocational-technical education has little effect in motivating students to become involved in social and/or community organizations. They seem to participate in such organizations to the same degree as the general public.

- VTAE graduates receive more promotions on the average than do high school students entering directly into the labor market.

- High school graduates find a job faster following their graduation than do VTAE graduates.

- There are several personality traits and/or abilities which a greater percentage of VTAE graduates feel they have than do high school graduates. They include: academic ability, drive to achieve, idealism, mechanical ability, and resourcefulness.

- Vocational, technical, and adult institutes do a good job in the placement of graduates. However, in the present study and in many related studies, VTAE graduates are continuing their education either at another vocational school or at the college level. They feel that more can and should be done for students like themselves who plan to continue their education rather than look for a job.

Mertens, D. M., McElwain, D., Garcia, G. and Whitmore, M. The Effects of Participating in Vocational Education: Summary of Studies Reported Since 1968. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1980.

This report summarizes 232 studies on the effects of participating in vocational education in order to determine whether there are consistent findings across studies for certain selected variables. Seventeen variables were used and the studies were limited to the years 1968 to 1979. Postsecondary and secondary programs were reviewed separately.

The findings focus on the relationship between education and employment. They include: no difference was found in unemployment rates for vocational and non-vocational secondary graduates, although postsecondary vocational graduates had lower unemployment rates; a majority of all vocational graduates find jobs in training-related areas. Other findings relate to earnings, basic skill attainment and academic abilities, further education, and level of satisfaction with training.

Sparks, D. A Synthesis of Research Findings Which Describe Selected Benefits and Outcomes for Participants in Vocational Education. Washington, DC: U.S. Office of Education, Bureau of Occupational and Adult Education, 1977.

This study identifies and explores the benefits of vocational education. It examines the experiences of vocational graduates in an effort to clarify how well vocational training serves its participants.

The methodology employed includes a literature search using post-1970 ERIC indices, an examination of evaluation studies housed at the Bureau of Occupational and Adult Education, and contacts with persons familiar with vocational research.

The studies show that vocational graduates generally do as well as, or better than, graduates of other curricula. Furthermore, vocational programs serve students from a lower socioeconomic background, a population that in general receives fewer benefits from academic or general education. Finally, in examining benefits, the author questions why vocational programs must constantly justify themselves by providing precise data to show that they benefit students in tangible, economic ways.

Swanson, A. D. A Study of the Costs, Benefits, and Effectiveness of Occupational Education. Buffalo, NY: State University of New York, 1976.

This paper describes the methodology, findings, and conclusions of an eight year longitudinal study of the costs, benefits, and effectiveness of occupational education offered in a Board of Cooperative Education Services (BOCES) district. The objectives of the study were to:

- Calculate and compare the costs per pupil for vocational programs offered by a regional school district in the metropolitan area of Buffalo, New York, with the costs of other programs offered by other regional districts of the same metropolitan area.
- Compare the success of graduates of vocational programs, measured by employment, earnings, and selected non-monetary considerations, with the performance of non-college bound graduates of academic high schools.
- Calculate benefit-cost ratios for vocational programs.
- Develop decision matrices for evaluating the likely cost and effectiveness of alternative approaches for meeting district objectives for occupational education.

The study consisted of three phases. First, costs per pupil for the 1972-73 school year were computed for the 16 occupational programs offered by BOCES. Second, economic and noneconomic information on graduates of both BOCES and regular high school programs were gathered from school records and through a mail/telephone survey. Two instruments were used: the School Record Form and the Alumni Survey Form. Third, comparative costs, cost-benefit ratios, and cost-effectiveness ratios were computed for both BOCES and academic high school programs.

Among the study's conclusions were that costs and cost-benefit ratios varied by program area within the BOCES district. In particular, the returns to investment in many high cost vocational programs were negative. In addition, the study found that earnings for male BOCES students were slightly higher than for non-BOCES students. However, the earnings were not high enough to compensate for the greater program costs. Female BOCES students earned somewhat less than non-BOCES students. However, this difference was attributed to socioeconomic and school achievement factors and not to type of training.

Taussig, M. K. "An Economic Analysis of Vocational Education in the New York City Schools." Journal of Human Resources 3 (1968): 59-87.

Taussig presents the findings of his cost-benefit study of vocational education in New York City based on data through 1965. He focuses upon the employment experience of graduates from city vocational schools. Taussig's research is an example of some of the early cost-benefit studies that found that vocational training did not increase the market productivity of the graduates despite the large incremental costs of vocational training. He further suggested that the schools' criteria for measuring program success are largely irrelevant from a public interest viewpoint.

Vocational Education Data Sources

Brown, L. III, Barnes, R., Currence, M. and Henderson, D. Research Data Resources in Vocational Education: An Assessment. Washington, DC: U.S. Department of Education, Office of the Assistant Secretary for Planning and Evaluation, 1980.

This paper presents a review of past and current research and data collection activities in vocational education. Studies reviewed were limited to those performed or sponsored between 1972 and 1980 by the Department of Health, Education, and Welfare. The paper discusses 48 studies specifically. These studies were selected on the criteria of being relevant, objective and unbiased, reliable, based on systematic information, and capable of generalization. These 48 studies may be divided into six broad issue areas: (1) access, including sex equity; (2) funding, especially Federal level to state level disbursements; (3) planning and management, including state and local compliance with Federal statutory and regulatory requirements; (4) quality and effectiveness, primarily in terms of student economic and educational outcomes; (5) education and work, including CETA linkages with schools; and (6) general/miscellaneous studies.

Of particular importance to potential cost-benefit study teams is a review of data resources which could be utilized in vocational education studies. The report considered five data resources to be of superior value. They are: (1) the High School and Beyond Longitudinal Survey; (2) the National Longitudinal Survey - 1979; (3) National Longitudinal Study of the High School Class of 1972; (4) Berkeley Survey of Vocational Schools in 10 states; and (5) the 1966 National Longitudinal Survey. The report cited deficiencies in the Vocational Education Data System (VEDS) data as well as the BOAE annual statistical reports. The major problems with VEDS are: (1) the lack of a standard definition of program enrollees; (2) the absence of information on program duration and length of classroom exposure; and (3) the lack of comparison standards for interpreting reported outcomes.

Brown, L. III and Gilmartin, K. J. Report #1. Measures of Participation in Vocational Education: Enrollments, Students and Exposure. Washington, DC: U. S. Department of Education, Office of Planning and Budget, Office of Technical and Analytical Systems, 1980.

This study, prepared to coincide with Congressional consideration of reauthorizing the Vocational Amendments of 1976, critically reviews the official enrollment statistics published annually by the Bureau of Occupational and Adult Education (BOAE). The review is performed by comparing the BOAE data with the National Center for Education Statistics (NCES) data collected in a 1972 survey of vocational education students in secondary schools. The analysis discusses several vocational education accounting concepts and reporting procedures that affect the interpretation of official data for projected enrollments and future funding. Specifically, the report criticizes the BOAE data for overestimating participation in secondary school vocational programs. For example, the practice of reporting course enrollments rather than number of students can overstate by over one million the number of unduplicated program students.

The implication of the analysis is that the reduced number of vocational students will increase the estimated cost per student. Costs per full-time equivalent vocational student will be approximately three times higher than per student costs for non-vocational secondary programs.

The report provides an excellent analysis of appropriate measures of participation in vocational education programs. The authors propose a measure of participation which would account for: (1) duplication arising from a student enrolled in more than one vocational class or enrolled in a class that is part of two vocational programs; (2) number of hours of class time; and (3) the "lifecycle" of a vocational program. The authors assert that because of major differences in patterns of educational exposure for vocational program areas, studies of vocational education's effectiveness should concentrate on individual programs rather than analyze averages computed over a heterogeneous set of training programs.

Ghazalah, I. A. "Economic Performance of Vocational Education Graduates: A Study Based on U.S. Individual Income Tax Data." The Journal of Vocational Education Research (1981): forthcoming.

The major objective of the research reported in this article is to devise ways to utilize existing data to analyze the impact of vocational education on the performance of its graduates. Most current research uses earnings and other related data collected through personal surveys as a measure of vocational benefits. Ghazalah shows how data taken from U.S. individual tax returns filed with the Internal Revenue Service (IRS) can provide a less costly and more timely alternative to survey data.

The author displays an application of these data by studying 10,731 eleventh and twelfth grade vocational graduates who took the Ohio Trade and Industrial Education Achievement Test in 1971. He uses the IRS income data as a source of information on these students' earnings as well as a proxy for their employment rates (the number of students filing tax returns) and their interregional mobility (the number of students filing tax returns in 1974 by region versus the number of vocational students in 1971 by region).

Golladay, M. A. and Wulfsberg, R. M. The Condition of Vocational Education: Review Edition. Washington, DC: National Center for Education Statistics, 1980.

This report was prepared to supplement testimony to the Subcommittee on Elementary, Secondary, and Vocational Education, Committee on Education and Labor, U.S. House of Representatives. The report characterizes vocational education's providers, offerings, students, facilities, instructional staff, and finances.

The report also presents statistical tables regarding the condition of vocational education. Many of the tables were previously unpublished. These include tables related to institutional providers of vocational education, enrollments, profiles of students, staff, facilities, allocations and expenditures, costs facing vocational students, and outcomes of vocational education.

Grasso, J. T. and Shea, J. R. "Effects of Vocational Education Programs: Research Findings and Issues." The Planning Papers for the Vocational Education Study. Washington, DC: National Institute of Education, 1979.

This is an overview of existing data bases, vocational education evaluations, and cost-benefit study findings. Grasso and Shea begin by synthesizing the data and research based on the results of four national longitudinal surveys: Project Talent, Youth in Transition, the National Longitudinal Surveys, and the National Longitudinal Study of the High School Class of 1972.

They then summarize various vocational evaluation and cost-benefit study findings for the data bases by subject area. Findings are reported on vocational students' socioeconomic status and innate ability, educational aspirations, attitudes towards school, occupational goals, career choices, post-school training, economic success, and psychological capability.

Hopkins, C. O. Data Sources for Vocational Education Evaluation. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

This paper summarizes the informational needs, potential data sources, and data deficiencies for evaluation of vocational education programs. The primary sources for evaluation data are: Bureau of Labor Statistics, Bureau of Census, state employment security agencies, National Center for Education Statistics and state management information systems. The paper includes two informative appendices. The first describes major sources of data by broad data element needs. The second gives more detailed information concerning availability of specific information needs.

Kay, E. R. (ed.). Enrollments and Programs in Noncollegiate Postsecondary Schools, 1978. Washington, DC: National Center for Education Statistics, 1979.

This resource is a compilation of statistics, figures, and tables on the number of students preparing for technical careers in noncollegiate postsecondary schools. The text is divided into separate findings for correspondence schools and noncorrespondence schools. The data were collected from a sample of schools in conjunction with the development of the Directory of Postsecondary Schools with Occupational Programs.

Lee, A. M. Use of Evaluative Data by Vocational Educators. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

In this paper, Lee notes that considerable research exists on approaches to and procedures for evaluation research in vocational education. However, very little has been written on the use of the research by vocational educators. This paper is intended to provide some scholarship in this area.

He first describes conditions that govern the use of vocational data. These include availability, reliability, credibility, and utility. Lee then discusses potential and actual uses of evaluative data by vocational educators and the effectiveness in the use of these data. He concludes by making five recommendations for the further use of evaluative data.

Lee, A. M. "The Vocational Education Data Base." *The Planning Papers for the Vocational Education Study*. Washington, DC: National Institute of Education, 1979.

This paper surveys the availability and quality of vocational education data on the local, state, and federal levels. Lee suggests that the primary failing of existing data is incompatibility. This incompatibility is the result of such factors as lack of quality control at the federal level, unstandardized definitions of course enrollment and curriculum, variations in the automated reporting capacities of states and localities, and the time delay between the school year and data availability.

Lee writes that two major elements in improving data consistency, and thereby data quality, can be federal reporting requirements and the further development of automated information systems. However, there are a number of obstacles to the potential impact of federal reporting:

- Many states are unwilling to let the federal government dictate data elements and data format.
- Various political ramifications may undermine the intentions of reporting systems.
- Inadequate funding and staff prevent maintenance of reporting quality.

Pucell, D. J. Longitudinal Methods as Tools for Evaluating Vocational Education. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

This paper presents the advantages and disadvantages of using longitudinal methods of evaluating vocational education. The literature review for this paper indicates that longitudinal methodologies have not been often utilized by vocational educators. The author suggests that this method would be most useful in answering questions such as:

- Does vocational education make a difference?
- What program practices increase the possible success of vocational graduates?
- What are the additional costs of preparing special needs students for employment?

Longitudinal data bases generated on a continual basis would allow educators to ask questions and examine relationships which would more readily provide information on the impact of program changes upon students.

Woods, E. M. "National Longitudinal Studies and Data Sets." VocEd 55 (September 1980): 35-38, 63.

In this article, Woods has identified several common methodological concerns regarding the use of longitudinal data. Five national longitudinal data sets are specifically reviewed regarding their relevancy to an evaluation of vocational education. These data sets are: Project Talent; Youth in Transition; National Longitudinal Surveys; National Longitudinal Study of the High School Class of 1972; and National Longitudinal Survey (new cohort).

Several limitations were noticed in a cross comparison of the selected data sets. Since each data set was collected with different objectives in mind, the sample size and type varies. Also, vocational programs have changed between the oldest study (1960) and the newest study (1979).

Woods also discusses potential sources of discrepancies in defining a vocational student and course of study. First, students and administrators may have varying perceptions of the kind of program in which the student participated. Program classifications differ according to the researcher's approach as well. The tendency to group all vocational programs in the same category without regard to quality, content, duration, and intensity is also a problem.

In reviewing program outputs, Woods empahsizes the need to control for differences in student background and other variables. The problems in over-aggregation are also noted. Becasue of the dificiencies in the available data, Woods asserts that "we should probably not even try to estimate effects, but instead, in accordance with the limitations of the available data, merely estimate outcomes associated with different kinds of vocational education."

APPENDIX B
BIBLIOGRAPHIES

ECONOMICS OF EDUCATION

Akin, J.S. and Auten, G.E. "City Schools and Suburban Schools: A Fiscal Comparison." *Land Economics* 52 (November 1976): 452-466.

Alexander, K. and Jordan, K.F. *Financing the Public Schools of Indiana*. Gainesville, FL: Institute for Educational Finance, 1976.

Averch, H.A.; Carroll, S.J.; Donaldson, T.S.; Kiesling, H.J. and Pincus, J. *How Effective is Schooling? A Critical Review of Research*. Englewood Cliffs, NJ: Education Technology Publications, 1974.

Averch, H.A. and Kiesling, H.J. *The Relationship of School and Environment to Student Performance: Some Simultaneous Models for the Project TALENT High Schools*. Santa Monica, CA: The Rand Corporation, 1972.

Barlow, R. "Efficiency Aspects of Local School Finance." *Journal of Political Economy* 78 (September 1970): 1028-1039.

Benson, C.S. *The Economics of Public Education*. 2nd ed. Boston, MA: Houghton-Mifflin, 1968.

__________. *Education Finance in the Coming Decade*. Bloomington, IN: Phi Delta Kappa, Inc., 1975.

Berke, J.S.; Campbell, A.K. and Goettel, R.J. *Financing Equal Educational Opportunity*. Berkeley, CA: McCutchan Publishing Company, 1972.

Berke, J.S. and Kirst, M.W. *Federal Aid to Education*. Lexington, MA: D.C. Heath and Company, 1972.

Berne, R. *A Methodological Assessment of Education Equality and Wealth Neutrality Measures*. New York, NY: New York University, Public Policy Research Institute, 1978.

Bishop, G.A. "Stimulative Versus Substitutive Effects of State School Aid in New England." *National Tax Journal* 17 (June 1964) : 133-143.

Blaug, M. *Economics of Education: A Selected Annotated Bibliography*. New York, NY: Pergamon Press, 1978.

__________. *An Introduction to the Economics of Education*. Baltimore, MD: Penquin Books, 1970.

Bowles, S. "Towards an Educational Production Function." *Education, Income, and Human Capital*. W.L. Hansen, ed. New York, NY: National Bureau of Economic Research, 1970.

Bradford, D.F.; Malt, R.A. and Oates, W.E. "The Rising Cost of Local Public Services: Some Evidence and Reflections." National Tax Journal 22 (June 1969): 185-202.

Brazer, H.E. and Anderson, A.P. "A Cost Adjustment Index for Michigan School Districts." Selected Papers in School Finance: 1975. E.O. Tron, ed. Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1975.

Brown, B.W. "Achievement, Costs, and the Demand for Public Education." Western Economics Journal 10 (June 1972): 198-219.

Burkhead, J. "Economics Against Education." Teachers College Record 75 (December 1973): 193-205.

Burkhead, J.; Fox, T.G. and Holland, J. Input and Output in Large City High Schools. New York, NY: Syracuse University Press, 1967.

Callahan, J.J.; Wilken, W.H. and Sillerman, M.T. Urban Schools and School Finance Reform: Promise and Reality. Washington, DC: The National Urban Coalition, 1973.

Cohn, E. Economics of State Aid to Education. Lexington, MA: D.C. Heath and Company, 1974.

__________. "Economies of Scale in Iowa High School Operations." Journal of Human Resources 3 (Fall 1968): 422-434.

Coleman, J.S., et al. Equality of Educational Opportunity. Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1966.

Coombs, P. and Hallack, J. Managing Education Costs. New York, NY: Oxford University Press, 1972.

Coons, J.E.; Clune, W.H. and Sugarman, S.D. Private Wealth and Public Education. Cambridge, MA: Harvard University Press, 1970.

Cubberly, E.P. School Funds and Their Apportionment. New York, NY: Columbia University Teachers College Press, 1906.

Feldstein, M.S. "Wealth Neutrality and Local Choice in Public Education." American Economic Review 65 (March 1975): 75-89.

Fox, T. "School System Resource Use in Production of Interdependent Educational Outputs." Paper presented at the joint national meeting of the American Astronautical Society and Operations Research Society, Denver, CO, 1969.

Friedman, M. "The Role of Government in Education." Economics and the Public Interest. R.A. Solo, ed. New Brunswick, NJ: Rutgers University Press, 1955.

Garms, W.I.; Guthrie, J.W. and Pierce, L.C. The Economics and Politics of Public Education. Englewood Cliffs, NJ: Prentice Hall, Inc., 1978.

Ginsburg, A.L. Patterns of Federal Aid to School Districts. Washington, DC: U.S. Department of Health, Education and Welfare, 1975.

Grubb, W.N. and Michelson, S. States and Schools. Lexington, MA: D.C. Heath and Company, 1974.

Hanushek, E. The Value of Teachers in Teaching. Santa Monica, CA: The Rand Corporation, 1970.

Johns, R.L. and Alexander, K. Alternative Programs for Financing Education. Gainesville, FL: National Educational Finance Project, 1971.

Johns, R.L.; Alexander, K. and Jordan, K. Financing Education. Columbus, OH: Charles E. Merrill Company, 1972.

Katzman, M.T. "Distribution and Production in a Big City Elementary System." Yale Economic Essays 8 (Spring 1968): 201-256.

Kenny, L.W.; Denslow, D. and Goffman, I.J. "Measuring Differences Among the Florida School Districts in the Cost of Education: An Alternative Approach." Selected Papers in School Finance: 1975. E.O. Tron, ed. Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1975.

Kiesling, H. Jr. A Study of Cost and Quality of New York School Districts. Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1970.

Levin, B.; Muller, T. and Sandoval, C. The High Cost of Education in Cities. Washington, DC: The Urban Institute, 1973.

Levin, H.M. "Equal Educational Opportunity and the Distribution of Educational Expenditures." Education and Urban Society 5 (February 1973): 149-176.

__________. "A New Model of School Effectiveness." Do Teachers Make a Difference? Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1970.

Lindman, E.L. Financing Vocational Education in the Public Schools. Los Angeles, CA: National Educational Finance Project, 1970.

McLure, W.P. Special Programs in Public Schools: Administrative and Financial Structures. Urbana-Champaign, IL: University of Illinois at Urbana-Champaign, Bureau of Educational Research, 1976.

Michelson, S. "The Association of Teacher Resourcefulness with Children's Characteristics." Do Teachers Make a Difference? Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1970.

Morrison, H.C. School Revenue. Chicago, IL: University of Chicago Press, 1930.

Mort, P.R. "Cost Quality Relationships in Education." Problems and Issues in Public School Finance. R.L. Johns and E.L. Morphet, eds. New York, NY: National Conference of Professors of Educational Administration, 1952.

__________. State Support for Public Education. Washington, DC: The American Council on Education, 1933.

Nollen, S.D. "The Economics of Education: Research Results and Needs." The Centennial Review 19 (September 1975): 55-77.

Perl, L.J. "Family Background, Secondary School Expenditure, and Student Ability." Journal of Human Resources 8 (Spring 1973): 156-180.

Perlman, R. The Economics of Education: Conceptual Problems and Policy Issues. New York, NY: McGraw-Hill Book Company, 1972.

Pincus, J. (ed.). School Finance in Transition. Cambridge, MA: Ballinger Publishing Company, 1974.

Porter, D.O. The Politics of Budgeting Federal Aid: Resource Mobilization by Local School Districts. Beverly Hills, CA: Sage Publications, 1973.

Raymond, R. "Determinants of the Quality of Primary and Secondary Public Education in West Virginia." Journal of Human Resources 3 (Fall 1968): 450-470.

Reischauer, R.D. and Hartman, R.W. Reforming School Finance. Washington, DC: The Brookings Institution, 1973.

Rogers, D.C. and Richlin, H.S. Economics and Education: Principles and Applications. New York, NY: The Free Press, 1971.

Ross, J.P. and Burkhead, J. Productivity in the Local Government Sector. Lexington, MA: D.C. Heath and Company, 1974.

Sacks, S. City Schools/Suburban Schools. Syracuse, NY: Syracuse University Press, 1972.

Schultz, T.W. The Economic Value of Education. New York, NY: Columbia University Press, 1963.

Shaycoft, M.F. The High School Years: Growth in Cognitive Skills. Pittsburgh, PA: University of Pittsburgh, School of Education, 1967.

Shugoll, M.A. "The Productivity of Educational Revenues: A Concern in the Coming Decade." Paper presented at the annual meeting of the American Education Finance Association, New Orleans, LA, 1981.

Strayer, G.D. and Haig, R.M. The Financing of Education in the State of New York. New York, NY: The MacMillan Co., 1927.

Updegraff, H. and King, L.A. Survey of the Fiscal Policies of the State of Pennsylvania in the Field of Education. Philadelphia, PA: University of Pennsylvania Press, 1922.

Young, D.R.; Grasso, S.; Grennon, J. and Brandon, D. "Productivity Effects of State Formula Grants." Paper presented at the annual meeting of the Public Choice Society, New Orleans, LA, 1978.

COST-BENEFIT AND EDUCATION EVALUATION THEORIES

Amacher, R.C.; Tollison, R.D. and Willett, T.D. Economic Approach to Public Policy. Ithaca, NY: Cornell University Press, 1976.

Anderson, S.B.; Ball, S.; Murphy, R.T., et al. Encyclopedia of Educational Evaluation. San Francisco, CA: Jossey-Bass, Inc., 1975.

Arora, M. Forms for Establishing Societal Costs and Benefits of Vocational and Manpower Programs. Menomonie, WI: University of Wisconsin-Stout, Center for Vocational, Technical and Adult Education, 1977.

Ash, L.C. Instruments and Procedures for the Evaluation of Vocational/Technical Education. Washington, DC: American Vocational Assocation, 1973.

Barsby, S.L. Cost-Benefit Analysis and Manpower Programs. Lexington, MA: D.C. Heath and Company, 1972.

Baumol, W.J. Economic Theory and Operations Analysis. 3rd ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1972.

__________. "On the Social Rate of Discount." American Economic Review 58 (September 1968): 788-802.

Blaschke, C.L. and Sweeney, J.M. "Cost-Effective Analysis in Education." Paper presented at the annual meeting of the American Association of School Administrators, Atlantic City, NJ, 1976.

Branch, R.L. Evaluation System Model for the Basic Functions of Vocational Education in California: A Computer Based Evaluation System for Vocational Education. Sacramento, CA: Sacramento County Department of Education, 1972.

Cardus, D.; Fuhrer, M.J.; Thrall, R.M., et al. A Benefit-Cost Approach to the Prioritization of Rehabilitative Research. Houston, TX: Baylor College of Medicine, The Institute for Rehabilitation and Research, 1980.

Carpenter, M.B. and Haggart, S.A. "Cost-Effectiveness Analysis for Educational Planning." Education Technology 10 (October 1970): 26-30.

Chern, H.I. and Pettibone, T.J. "A Two Year Study of Public Vocational School Graduates." *Journal of Vocational Behavior* 3 (1973): 99-101.

Chinitz, B. and Tiebout, C.M. "The Role of Cost-Benefit Analysis in the Public Sector of Metropolitan Areas." *The Public Economy of Urban Communities*. J. Margolis, ed. Washington, DC: Resources for the Future, Inc., distributed by Johns Hopkins Press, 1965.

Cohn, E. "On the Net Present Value Role for Educational Investment." *Journal of Political Economy* 80 (March/April 1972): 418-420.

The Coordination of Program Planning and Evaluation Systems for Occupational Education, Volume 3: Monitoring Systems for Occupational Education. New York, NY: Riverside Research Institute, 1974.

Copa, G. "Cost Effectiveness/Benefit Analysis in Vocational Education Research." Paper presented at the annual meeting of American Vocational Education Research Association, Dallas, TX, 1978.

Copa, G. and Maurice, C.F. *People's Need for Additional Job Training: Development and Evaluation of an Assessment Procedure*. Minneapolis, MN: Minnesota Research Coordinating Unit for Vocational Education, 1976.

Darcy, R.L. "Evaluating Vocational Education on the Basis of Outcomes." Paper presented at the annual convention of the American Vocational Association, Anaheim, CA, 1979.

__________. *Some Key Outcomes of Vocational Education: A Report on Evaluation Criteria, Standards, and Procedures*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1980.

__________. *Vocational Outcomes: Perspective for Evaluation*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

Darcy, R.L.; Bolland, K.C. and Farley, J. *Vocational Education Outcomes* (Final Report on Year 1 of the research and development project, "Examining Vocational Education and Their Correlates"). Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

Darcy, R.L.; Bolland, K.C.; Farley, J. and Taylor, M. *Examining Vocational Education Outcomes and Their Correlates*. Columbus, OH: Ohio State University, The National Center for Research in Vocational Education, 1979.

Datta, L. "Better Luck Next Time: From Federal Legislation to Practice in Evaluating Vocational Education." Unpublished manuscript, 1978.

David, H. "The NIH Vocational Education Study - A Progress Report." Paper presented at the annual convention of the American Vocational Association, Anaheim, CA, 1979.

David, H. and Hendrickson, G. (eds.). *The Planning Papers for the Vocational Education Study* (Publication Number 1). Washington, DC: National Institute of Education, 1979.

Davie, B.F. "Benefit/Cost Analysis of Vocational Education: A Survey." *Occupational Education--Planning and Programming. Volume Two*. A. Kotz, ed. Menlo Park, CA: Stanford Research Institute, 1967.

__________. *Using Cost-Benefit Analysis in Planning and Evaluating Vocational Education*. Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1967.

Denison, E.F. *Accounting for United States Economic Growth 1929-1969*. Washington, DC: The Brookings Institution, 1974.

Denton, W.T. *Program Evaluation in Vocational and Technical Education*. Columbus, OH: Ohio State University, Center for Vocational and Technical Education, 1973.

Dorfman, R. (ed.). *Measuring Benefits of Government Investments*. Washington, DC: The Brookings Institution, 1965.

Easom, K.C., et al. *Local Educational Assessment Program Guide 6. Follow-up and Cost Analysis Guide*. Athens, GA: Athens Area Vocational Technical School, 1978.

Educational Research Library, National Institute of Education. *Indicators of Performance of Educational Systems*. Paris: Organization for Economic Cooperation and Development, 1973.

Egginton, E. "Is Vocational Education Meeting Its Objectives?" *Phi Delta Kappan* 50 (April 1978): 533-534.

English, J.M. (ed.). *Cost-Effectiveness*. New York, NY: John Wiley and Sons, 1968.

Estimating Cost/Benefits Through Analysis: A Programmed Guide for Local Vocational Directors. Tallahassee, FL: Florida State Division of Vocational Education, 1977.

Farley, J. *Vocational Education Outcomes: A Thesaurus of Outcome Questions*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

Fisher, G.H. *Cost Considerations in Systems Analysis*. New York, NY: American Elsevier Publishing Co., 1971.

Fishkind, H.M.; Milliman, J.W. and Ellson, R.W. *Methodology for Determining Needs for Vocational and Technical Education in Urban Areas in Florida*. Gainesville, FL: University of Florida, College of Business Administration, 1976.

Flynn, D.L. *Educational Cost Analysis* (Occasional Paper). Bethesda, MD: The RMC Corporation, 1975.

Forbes, R.H. "Cost-Effectiveness Analysis: Primer and Guidelines." *Educational Technology* (March 1974): 21-27.

Fox, K.A. (ed.). *Economic Analysis of Educational Planning*. Baltimore, MD: Johns Hopkins University Press, 1972.

Franchak, S.J. and Spirer, J.E. *Evaluation Handbook: Volume I, Guidelines and Practices for Follow-up Studies of Former Vocational Education Students*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1978.

Glass, L.I.; Simison, D.L. and Thrall, R.M. *Feasibility Study for the Evaluation of Methodologies for Cost-Benefit Analysis of Restoration Services in Rehabilitation* (Final Report). Falls Church, VA: Rehab Group, Inc., 1979.

Goffman, I., et al. *The Concept of Education as an Investment*. U.S. Government Printing Office, 1972.

Goldman, T.A. (ed.). *Cost-Effectiveness Analysis*. New York, NY: Praeger Publishers, 1967.

Grasso, J.T. *Impact Evaluation in Vocational Education: The State of the Art*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

Grasso, J.T. and Shea, J.R. *Vocational Education and Training: Impact on Youth*. Berkeley, CA: Carnegie Foundation for the Advancement of Teaching, 1979.

Hale, J.A.; Starnes, P.M. and Mickler, W.A. *The Development and Testing of a Model for Determining the Costs of Vocational Education Programs and Courses* (Final Report). Gainesville, FL: University of Florida, Institute for Educational Finance, 1977.

Hamermash, D.S. *Economic Aspects of Manpower Training Programs. Theory and Policy*. Lexington, MA: D.C. Heath and Company, 1971.

Hammons, J.O. *Improving Instruction and Cost-Effectiveness*. Washington, DC: American Association of Community and Junior Colleges, 1974.

Hansen, W.L. "Total and Private Rates of Return to Investment in Schooling." *Journal of Political Economy* 71 (1963): 128-140.

__________. (ed.). *Education, Income and Human Capital*. New York, NY: Columbia University Press, 1970.

Hansen, W.L. and Weisbrod, B.A. *Benefits, Costs, and Finance of Public Higher Education*. Chicago, IL: Markham Publishing Company, 1969.

Hatry, H.P.; Blair, L.; Fisk, D. and Kimmel, W. Program Analysis for State and Local Governments. Washington, DC: The Urban Institute, 1976.

Haveman, R.H. "Benefit-Cost Analysis: Its Relevance to Public Investment Decisions: Comment." The Quarterly Journal of Economics 81 (1967): 695-702.

__________. The Economics of the Public Sector. 2nd ed. New York, NY: John Wiley & Sons, 1976.

Haveman, R.H. and Margolis, J. (eds.). Public Expenditures and Policy Analysis. Chicago, IL: Markham Publishing Company, 1970.

Heinemann, H.N. and Susna, E. "Criteria for Public Investment in the Two-Year College: A Program Budgeting Approach." Journal of Human Resources 6 (Spring 1971): 171-184.

Hinrichs, H.H. and Taylor, G.M. Program Budgeting and Benefit-Cost Analysis. Pacific Palisades, CA: Goodyear Publishing Company, 1969.

Hirshleifer, J.; Dehaven, J.C. and Milliman, J.W. Water Supply: Economics, Technology, and Policy. Chicago, IL: University of Chicago Press, 1960.

Holleman, I.T. Jr. The Use of Economic Analytical Tools in Quantifying and Measuring Educational Benefits and Costs. n.p., 1975.

Hosken, R.A. Jr. "A Conceptual Cost Accounting Model for a Community Junior College." Unpublished Doctoral Dissertation, University of Florida, 1971.

Hu, T. and Stromsdorfer, E.W. "Cost-Benefit Analysis of Vocational Education." Handbook of Vocational Education Evaluation. C.K. Tittle and L. Cohen, eds. Beverly Hills, CA: Sage Publications, Inc., 1979.

Huck, J.F.; Miller, H.G., et al. Delivering Vocational Instruction to Adult Learners. Carbondale, IL: Southern Illinois University, 1976.

Humphrey, D.A. "Instructional Cost Analysis: History and Present Inadequacies." Paper presented at the third National Conference on Behavior Research and Technology in Higher Education, Atlanta, GA, 1975.

Johnson, D.W. "Affective Outcomes." Evaluating Education Performance. H.J. Walberg, ed. Berkeley, CA: McCutchan Publishing Company, 1974.

Johnson, T. "Returns on Investment in Human Capital." American Economic Review 60 (September 1970): 546-560.

Jones, H. A Model for Manpower Training Evaluation. McLean, VA: Planning Research Corp., 1972.

Kaufman, J.J. "Cost/Benefit--Cost/Effectiveness." What's Ahead for Vocational Education (Selected Presentations from the National Conference on Program Planning and Evaluation). Washington, DC, 1967.

__________. *Cost Effectiveness Analysis as a Method for the Evaulation of Vocational and Technical Education*. Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1968.

Kievit, M.B. "Perspectivism in Choosing and Interpreting Outcome Measures in Vocational Education." Paper presented to the National Conference on Outcome Measures, Louisville, KY, 1978.

Killingsworth, C.C. "Manpower Evaluations: Vulnerable But Useful." *Monthly Labor Review* 4 (April 1975): 51-84.

Kim, J.E. *A Cost Effectiveness-Benefit Analysis Model for Postsecondary Vocational Programs* (Technical Report). Bloomington, IN: Indiana University, Department of Vocational Education, 1977a.

__________. *Development of a Cost-Effectiveness/Benefit Analysis Model and User's Manual for Postsecondary Vocational Programs* (Final Report). Bloomington, IN: Indiana University, Department of Vocational Education, 1977b.

__________. *Developmental Strategies and Analytical Techniques for Improving the Cost-Effectiveness of Vocational Programs* (Handbook). Bloomington, IN: Indiana University, Department of Vocational Education, 1978.

__________. "Improving the Cost-Effectiveness of Vocational Education Programs: Perspectives and Problems." *Educational Technology* 20 (March 1980): 43-86.

Kim, J.E. and Harris, R.C. *A Cost-Effectiveness Analysis Model for Secondary Vocational Programs* (Technical Report). Bloomington, IN: University of Indiana, Department of Vocational Education, 1976.

Lawrence, B., et al. *Outputs of Higher Education: Their Identification, Measurement and Evaluation*. Boulder, CO: Western Interstate Commission for Higher Education, 1970.

Lecht, L.A. *Evaluating Vocational Education: Policies and Plans for the 1970's*. New York, NY: Praeger Publishers, 1974.

Levin, H.M. "Cost-Effectiveness Analysis in Evaluation Research." *Handbook of Evaluation Research*. M. Guttentag and E.L. Struening, eds. Beverly Hills, CA: Sage Publications, 1975.

__________. *The Costs to the Nation of Inadequate Education*. Washington, DC: U.S. Government Printing Office, 1972.

Levin, H.M.; Guthrie, J.W.; Kleindorfer, G.B. and Stout, R.T. "School Achievement and Post-School Success: A Review." *Review of Educational Research* 41 (1971): 1-16.

Lewis-Epstein, N. "Vocational Education." *High School and Beyond: Policy Issues and Research Designs*. J. Coleman, et al., eds. Chicago, IL: National Opinion Research Center, 1979.

Maass, A. "Benefit-Cost Analysis: Its Relevance to Public Investment Decisions." *The Quarterly Journal of Economics* 80 (May 1966): 208-226.

Magisos, J.H. "The Wilms Study: Analysis of Policy Implications for Vocational Education." *The Journal of Vocational Education Research* 1 (Winter 1976): 11-19.

Marglin, S.A. "The Social Rate of Discount and the Optimal Rate of Investment." *Quarterly Journal of Economics* 77 (1963): 95-112.

Marotzke, E. *A Study to Assess the Feasibility of Developing Measures of the Quality of Training Provided in CETA*. Minneapolis, MN: Great Lakes Research, Inc., (study in progress).

McKinney, F. *Program Evaluation in Vocational Education: A Review*. Columbus, OH: Ohio State University, Clearinghouse on Career Education, 1977.

McKinney, F.; Gray, K. and Abram, M. *Interpreting Outcome Measures in Vocational Education: A Final Report*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1978.

Meyer, R.H. and Wise, D.A. *High School Preparation and Early Labor Force Experience*. Cambridge, MA: Harvard University, John Fitzgerald Kennedy School of Government, 1980.

Mishan, E.J. *Cost-Benefit Analysis*. 2nd ed. New York, NY: Praeger Publishers, 1976.

________. *Economics for Social Decisions: Elements of Cost-Benefit Analysis*. New York, NY: Praeger Publishers, 1971.

Mohrenweiser, G., et al. *Planning Design for Conducting a National Survey of the Differential Cost of Vocational Education*. Minneapolis, MN: Educational Management Services, Inc., 1979.

Mood, A.M. and Powers, R. *Cost-Benefit Analysis of Education*. Washington, DC: National Center for Education Statistics, 1967.

Musgrave, R.A. "Cost-Benefit Analysis and the Theory of Public Finance." *Journal of Economic Literature* 7 (1969): 797-806.

Musgrave, R.A. and Musgrave, P.B. *Public Finance in Theory and Practice*. New York, NY: McGraw Hill Book Company, 1976.

Mushkin, S. (ed.). *Public Prices for Public Products*. Washington, DC: The Urban Institute, 1972.

National Institute of Education. *A Plan for the Study of Vocational Education*. Washington, DC: U.S. Government Printing Office, 1977.

National Institute of Education. The Vocational Education Study: The Interim Report. Washington, DC: U.S. Government Printing Office, 1980.

Niskanen, W.A.; Harberger, R.H.; Haveman, R.H.; Turvey, R. and Seckhauser, R. (eds.). Benefit-Cost and Policy Analysis. Chicago, IL: Aldine, 1973.

Nystrom, D.C. and Hennessy, J.V. "Cost Differential Analysis: Providing Data for Added Cost Funding." Journal of Industrial Teacher Education 13 (1976): 53-61.

O'Boyle, E.J. "The Problem of Evaluating Institutional Training Under the Manpower Development and Training Act." Review of Social Economy 32 (April 1974): 32-48.

O'Brien, R. Cost Model for Large Urban Schools. Washington, DC: National Center for Education Statistics, 1967.

__________. School Submodel for Large Urban Schools. Washington, DC: National Center for Education Statistics, 1967.

Oetting, E.R. "Evaluative Research and Orthodox Science: Part I." Personnel and Guidance Journal (September 1976): 11-15.

Okun, A.M. Equality and Efficiency: The Big Tradeoff. Washington, DC: The Brookings Institution, 1975.

Peterson, L.J. Cost-Benefit Theory: Vocational and Technical Education. Madison, WI: University of Wisconsin, Center for Studies in Vocational, Adult and Technical Education, 1969.

Prest, A.R. and Turvey, R. "Cost-Benefit Analysis: A Survey." The Economic Journal 75 (December 1965): 683-732.

Psacharopoulos, G. and Hinchliffe, K. Returns to Education. San Francisco, CA: Jossey-Bass, Inc., 1973.

Pucell, D.J. "The Wilms Study: Analysis of Methodology." Journal of Vocational Research 1 (Winter 1976): 3-10.

Quade, E.S. Analysis for Public Decisions. New York, NY: American Elsevier Publishing Co., 1975.

Raiffa, H. Decision Analysis: Introductory Lectures on Choices Under Uncertainty. Reading, MA: Addison-Welsey Publishing Company, 1968.

Reinhart, B. and Blomgren, H. Cost Benefit Analysis--Trade and Technical Education (Final Report). Los Angeles, CA: University of California, Division of Vocational Education, 1969.

Reubens, B.G. Vocational Education for All in High School? Work and the Quality of Life: Resource Papers for Work in America. J. O'Toole, ed. Cambridge, MA: Massachusetts Institute of Technology, 1974.

Robertson, L.R. "A System for Determining Educational Program Costs: Application to Comprehensive Community Colleges." Unpublished Doctoral Dissertation, Wayne State University, 1968.

Rothenberg, J. "Cost-Benefit Analysis: A Methodological Exposition." *Handbook of Evaluation Research*. M. Guttentag and E.L. Struening, eds. Beverly Hills, CA: Sage Publications, 1975.

Schetinin, V. "The Cost of Labor Power and Expenditures on Training." *Problems of Economics* 5 (September 1974): 83-91.

Schultz, T.W. "Capital Formation by Education." *Journal of Political Economy* 68 (1960): 571-583.

__________. "Investment in Education: The Equity-Efficiency Quandry." *Journal of Political Economy* 80 (1972 Supplement): 2-30.

Seiler, K. IV. *Introduction to Systems Cost-effectiveness*. New York, NY: Wiley-Interscience, 1969.

Sewell, D. "A Critique of Cost-Benefit Analysis of Training." *Monthly Labor Review* 29 (September 1967): 409-21.

Sewell, S.; Wagner, D.J. and Anderson, R.H. *Conceptual Framework for Conducting Cost-Benefit Studies in Wisconsin Vocational, Technical and Adult Education*. Fennimore, WI: Southwest Wisconsin Vocational-Technical Institute, 1974.

Smith, R.E. "The Opportunity Cost of Participating in a Training Program." *Journal of Human Resources* 6 (Fall 1971): 510-519.

Soong, R.K.; Wetzel, J.; Warren, B.; Hall, J.B. and Kich, G.A. *Cost-Benefit Considerations of New Careers Programs*. Chicago, IL: Career Options Research and Development, 1971.

Sorenson, W. *A Proposed System for Predicting Costs of Vocational Education Programs in California Community Colleges* (Final Report). Santa Clara, CA: West Valley Joint Community College, 1972.

Starr, H. and Dieffenderfer, R.A. *A System for Statewide Evaluation of Vocational Education*. Columbus, OH: Ohio State University, Center for Vocational and Technical Education, 1972.

State-of-the-Art Review of Evaluation Procedures in Vocational Education (Final Report). Belmont, MA: CRC Education and Human Development, Inc., 1978.

Stevenson, W.W. and Ward, W.G. *Conducting Evaluation Within a State: Information for State Leaders*. Columbus, OH: Ohio State University, Center for Vocational and Technical Education, 1972.

________. "Investing in Human Capital." Journal of Human Resources 1 (1966): 1-12.

Wentling, T.L. Evaluating Occupational Education and Training Programs. 2nd edition. Boston, MA: Allyn and Bacon, 1980.

Wiley, D.E. and Harnischfeger, A. High School Learning, Vocational Tracking, and What Then? Chicago, IL: ML-GROUP, CEMREL, 1980.

Williams, A. "Cost-Benefit Analysis: Bastard Science? and/or Insidious Poison in the Body Politick?" Benefit-Cost and Policy Analysis. W. Niskanen, ed. Chicago, IL: Aldine, 1973.

Wilms, W.W. and Hansell, S.E. "The Wilms Study: Anatomy of a Project." The Journal of Vocational Education Research 1 (Winter 1976): 20-28.

Woodhall, M. Cost-Benefit Analysis in Educational Planning. Paris: International Institute for Educational Planning, 1970.

Zymelmen, M. The Economic Evaluation of Vocational Training Programs. Baltimore, MD: Johns Hopkins University Press, 1976.

COST-BENEFIT APPLICATIONS IN VOCATIONAL EDUCATION

Adams, D.A. Review and Synthesis of Research Concerning Adult Vocational and Technical Education. Blacksburg, VA: Virginia Polytechnic Institute and State University, 1972.

Aldrich, D.G. An Analysis of Vocational Program Costs. Los Angeles, CA: The University of California, Graduate School of Education, 1972.

Allen, D. A Three-Year Follow-up Study. Los Angeles, CA: University of California, Division of Vocational Education, 1975.

Allen, R.E. and Gutteridge, G. "Intensity of Occupational Training: Its Effects on Subsequent Labor-Market Experience." Community/Junior College Research Quarterly 2 (1978): 367-380.

Anderson, E.F. "Differential Costs of Curricula in Comprehensive Junior Colleges." Unpublished Doctoral Dissertation, University of Illinois, 1966.

Andrew, D.C. and Roberts, L.H. A Comparative Study of the Occupational Achievement of Vocational and Non-Vocational High School Graduates in the State of Arkansas. Magnolia, AR: Educational Planning and Evaluation Services, 1974.

Baldwin, L.P. A Cost Accounting Model to Assess the Actual Cost of Vocational and Nonvocational Courses. CA: Office of the Chancellor, California Community Colleges, 1970.

Stromsdorfer, E.W. "Economic Concepts and Criteria for Investment in Vocational Education." Occupational Education--Planning and Programming, Volume Two. A. Kotz, ed. Menlo Park, CA: Stanford Research Institute, September, 1967.

__________. "Special Problems in the Economic Analyses of Investments in Human Resources." Socio-Economic Planning Sciences 5 (1971): 275-283.

Sum, A.; Mazyed, K.; McLaughlin, F. and Zornitsky, J. The Design and Implementation of Local Follow-up Evaluation Systems. Boston, MA: Employment and Training Administration, 1978.

__________. The Role of Program Evaluation at the Local Level. Boston, MA: Employment and Training Administration, 1978.

__________. The Use of Process Outcome and Benefit-Cost Analysis Techniques. Boston, MA: Employment and Training Administration, 1978.

Swift, W.J. and Weisbrod, B.A. "On the Monetary Value of Education's Intergeneration Effects." Journal of Political Economy 73 (December 1965): 743-749.

Taylor, M.; Darcy, R.L. and Bolland, K.A. Vocational Education Outcomes: Annotated Bibliography of Related Literature. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

Thurow, L. Investment in Human Capital. Belmont, CA: Wadsworth Publishing Co., 1970.

Venn, G. "Criteria Against Which Vocational Education Should be Held Accountable." Paper presented to the National Conference on Outcome Measures, Louisville, KY, 1978.

Warmbrod, J.R. "Cost-Benefit Analysis and Cost-Effectiveness Analysis in Education and Vocational Education." Vocational Education and the Nation's Economy. W. Meyer, ed. Washington, DC: American Vocational Association, 1977.

Webb, L.D. "The Development of a Model to Measure Selected Economic Externalities of Education." Unpublished Doctoral Dissertation, University of Florida, 1975.

Weiner, N.S. The United States Employment Service: A Conceptual Model of Output, Values, and Illustrative Estimations. Washington, DC: Boeing Computer, 1977.

Weisbrod, B.A. External Benefits of Public Education: An Economic Analysis. Princeton, NJ: Princeton University, Industrial Relations Section, 1964.

__________. "Income Redistribution Effects and Benefit-Cost Analysis." Problems in Public Expenditures Analysis. B. Chase Jr., ed. Washington, DC: The Brookings Institution, 1968.

Bentley, R.W. "An Exploration of Relationships Between Expenditures for Educational Programs for Exceptional Children and Expenditures for Regular Education Programs." Unpublished Doctoral Dissertation, University of Wisconsin, 1970.

Bergstrand, J.; Esser C. and Nilson, O. *Impacts of Secondary Vocational Education on Later Performance in Wisconsin's Postsecondary VTAE System.* Menomonie, WI: Center for Vocational, Technical and Adult Education, 1979.

Billings, R.S. "Job Satisfaction and Performance Measures: The State-of-the-Art." *Interpreting Outcome Measures in Vocational Education: A Final Report*. F. McKinney, ed. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1978.

Bobbitt, L.E. *Benefit-Cost Ratio and Rate of Return Analysis of Selected Programs in Florida's Postsecondary Schools*. Ann Arbor, MI: University Microfilms International, 1978.

Bolland, D.A. *Vocational Education Outcomes: An Evaluative Bibliography of Empirical Studies*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

Brandon, G.L. *An Appraisal of the Manpower Training Programs Established by Congress in the 1960's (Project Baseline Supplemental Report)*. Flagstaff, AZ: Northern Arizona University, 1974.

Breglio, V.J.; Stevens, M. and Tobias, J. *Assessment of School Supervised Work Education Programs Part II: Urban Cooperative Work Education Programs and Follow-up Study* (Final Report). San Francisco, CA: Olympus Research Centers, 1976.

Cage, R. *Cost Analysis of Selected Educational Programs in the Area Schools of Iowa*. Ames, IO: Iowa State University of Science and Technology, 1968.

Carroll, A.B. and Ihnen, L.A. *Costs and Returns of Technical Education: A Pilot Study*. Raleigh, NC: North Carolina State University, 1966.

________. "Costs and Returns for Two Years of Postsecondary Technical Schooling." *Journal of Political Economy* 75 (December 1967): 862-873.

Cohn, E.; Hu, T. and Kaufman, J. *The Costs of Vocational and Nonvocational Programs*. University Park, PA: Pennsylvania State University, Institute for Research on Human Resources, 1972.

Coles, G.J., et al. *Impact of Educational Innovation on Student Performance: Project Methods and Findings for 3 Cohorts* (Final Report, Volume I). Palo Alto, CA: American Institutes for Research in the Behavioral Sciences, 1976.

Collins, D.R. *An Assessment of Benefits Derived from Membership in a Vocational Student Organization in the Vocational, Technical and Adult Education System* (Final Report). Madison, WI: University of Wisconsin, 1977.

Condie, F.A. "A Model for Reporting Selected Instructional Costs and Accomplishments of Institutions of Higher Education with its Application to Three Institutions." Unpublished Doctoral Dissertation, Arizona State University, 1969.

__________. "Some Historical Effects of Vocational Education at the Secondary Level." *Phi Delta Kappan* 61 (December 1979).

Conroy, W.G. Jr. "The Economic Effects of Vocational Education." *VocEd* 55 (September 1980): 39-41, 61.

Conroy, W.G. Jr. and Diamond, D.E. *The Impact of Secondary School Occupational Education in Massachusetts*. Lowell, MA: The University of Lowell, 1976.

Cooley, T.R.; McGuire, T.W. and Prescott, E.C. *The Impact of Manpower Training on Earnings: An Econometric Analysis* (Final Report). Pittsburgh, PA: Carnegie-Mellon University, 1975.

Copa, G. and Kleven, B.A. *Job Selection Patterns: Linkage Between Vocational Education Programs and the Labor Market*. Minneapolis, MN: Minnesota Research Coordinating Unit for Vocational Education, 1977.

Corazzini, A.J. "The Decision to Invest in Vocational Education: An Analysis of Costs and Benefits." *Journal of Human Resources* 3 (1968 supplement): 88-120.

__________. *Vocational Education: A Study of Benefits and Costs*. Princeton, NJ: Princeton University, 1966.

A Cost-Effectiveness Analysis of the Vocational Education Program in Puerto Rico. San Juan, PR: Peat, Marwick, Mitchell and Company, 1971.

Creech, R.F. *Comparative Analysis of Postsecondary Occupational and Educational Outcomes for the High School Class of 1972*. Princeton, NJ: Educational Testing Service, 1977.

Curtis, T.D., et al. *An Analysis of the Impact of CETA, Title I Classroom Training on Vocational and Technical Education*. Tampa, FL: University of South Florida, College of Business Administration, 1976.

DeVore, J.B. and Scott, R.E. "A Societal Cost/Benefit Analysis Model." *Journal of Industrial Teacher Education* 11 (Spring 1974): 37-45.

Doty, C.R., et al. *Model for Calculating Cost per Pupil for Secondary Vocational, General and Transfer Curricula in Comprehensive High Schools, Shared Time Vocational Schools* (Final Report). New Brunswick, NJ: Rutgers University, Department of Vocational-Technical Education, 1976.

Dow, G. *CETA Cost Analysis* (Final Report). Ann Arbor, MI: University of Michigan, Institute of Public Policy Studies, 1977.

Eckaus, R.S. *Estimating the Returns to Education: A Disaggregated Approach*. Berkeley, CA: Carnegie Commission on Higher Education, 1972.

Engleman, S.R. *An Economic Analysis of the Job Corps*. Berkeley, CA: University of California, 1972.

Eninger, M.U. *An Analysis of Costs and Performance Factors for Operation and Administration of Vocational Schools for Secondary Programs*. Pittsburgh, PA: American Institutes for Research, 1967.

__________. *Effectiveness Evaluation Data for Major City Secondary Education Systems in the U.S.* Pittsburgh, PA: Educational Systems Research Institute, 1972.

Farber, D. "An Analysis of Change in Earnings of Participants in Manpower Training Programs" (Unpublished Report). Washington, DC: U.S. Department of Labor, 1972.

Fernback, S. and Somers, G. *An Analysis of Economic Benefits of Vocational Education at the Secondary, Postsecondary, and Junior College Levels*. Madison, WI: University of Wisconsin, 1970.

Florida State Advisory Council on Vocational and Technical Education. *Vocational-Technical Education in Human Resource Development in Florida: A Statewide Evaluation*. Tallahassee, FL: Florida State University, Department of Educational Administration, 1970.

Galloway, L.E. and Ghazalah, I.A. *The Role of Vocational Education in Improving Skills and Earning Capacity in the State of Ohio: A Cost-Benefit Study*. Athens, OH: Ohio University, College of Business Administration, 1972.

Gasior, A.G.; Kocinski, R.R. and Doty, C.R. *Longitudinal Study of Vocational Education Graduates and Utilization of Federal Income Tax Data*. Columbus, OH: Ohio State University, Department of Vocational Education, 1978.

__________. *Model for Cost per Pupil for Vocational Education Programs and Types of Schools (Final Report)*. New Brunswick, NJ: Rutgers University, Department of Vocational-Technical Education, 1975.

Ghazalah, I.A. "The Economic Value of Vocational Education: Report of a Study in Eighteen Schools." *American Vocational Journal* (1974).

__________. *The Role of Vocational Education in Improving Skills and Earning Capacity in the State of Ohio: A Cost-Benefit Study*. Athens, OH: Ohio University, College of Business Administration, Division of Business Research, 1972.

__________. *Vocational Education Planning Districts in Ohio: An Economic Evaluation of Foregone Benefits from Limited Participation*. Columbus, OH: Ohio State Department of Education, 1975.

Goldstein, J.H. The Effectiveness of Manpower Training Programs: A Review of Research on the Impact on the Poor. Washington, DC: U.S. Government Printing Office, 1972.

Grasso, J.T. and Shea, J.R. Vocational Education and Training: Impact on Youth. Berkeley, CA: Carnegie Foundation for the Advancement of Teaching, 1979.

Gubins, S. The Impact of Age and Education on the Effectiveness of Training: A Benefit-Cost Analysis. Baltimore, MD: Johns Hopkins University, 1972.

Hale, J.A. "Allocation of Indirect Costs and Allocation of Space and Equipment Costs." Cost of Vocational and Adult Education Programs in Florida. K. Alexander, ed. Gainesville, FL: University of Florida, Institute for Educational Finance, 1975.

Hamby, J.; Harper, R. and Myers, L. A Comparison Study of the Benefits of Secondary and Postsecondary Vocational Education. Portland, OR: Northwest Regional Educational Lab, 1978.

Hanoch, G. "An Economic Analysis of Earnings and Schooling." Journal of Human Resources 2 (Summer 1967): 310-329.

Hardin, E.; Nosow, S. and Borus, M.E. Economic Benefits and Costs of Retraining Courses in Michigan. Lexington, MA: D.C. Heath & Company, 1971.

Harris, G.W. and O'Fallon, K.O. Cost Analysis of Secondary School Vocational-Technical Education Programs. Knoxville, TN: University of Tennessee, Bureau of Educational Research and Service, 1973.

Harris, M.A. Benefit-Cost Comparison of Vocational Education Programs: Statewide Evaluation of Vocational-Technical Education in Florida. Tallahassee, FL: Florida State University, 1972.

Horvath, J. A Study of Community College Students Who Are Graduates of Vocational Technical and College Preparatory High School Curriculum. Schenckesville, PA: Lehigh County Community College, 1973.

Hu, T. Studies of the Cost-Efficiency and Cost-Effectiveness of Vocational Education. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1980.

Hu, T; Lee, M.L. and Stromsdorfer, E.W. "Economic Returns to Vocational and Comprehensive High School Graduates." Journal of Human Resources 6 (Winter 1971): 25-50.

Hu, T; Lee, M.L.; Stromsdorfer, E.W. and Kaufman, J.J. A Cost-Effectiveness Study of Vocational Education (Final Report). University Park, PA: Pennsylvania State University, 1969.

Indiana Cost Information Study Guidelines: 1975-1976. Indianapolis, IN: Commission for Higher Education, 1977.

Innes, J.T.; Jacobson, P.B. and Pelligrin, R.J. The Economic Returns to Education: A Survey of Findings. Eugene, OR: University of Oregon, Center for the Advanced Study of Educational Administration, 1965.

Ittner, F.E. Project to Develop a Cost-Benefit Model for Vocational Programs at College of Alameda (Final Report). Los Angeles, CA: University of California, Clearinghouse for Junior College Information, 1972.

Kamran, M.; Dudet, B.A. and Stromsdorfer, E.W. An Econometric Analysis of the Costs of Selected Manpower Programs. Bloomington, IN: Indiana University, 1974.

Karnes, M.B. The Efficacy of a Prevocational Curriculum and Services Designed to Rehabilitate Slow Learners Who Are School Dropout, Delinquency, and Unemployment Prone. Washington, DC: U.S. Department of Health, Education, and Welfare, 1966.

Kastner, H.H. Jr. "Cost/Benefit Analysis of Community College Education." Community College Review 4 (Winter 1976): 17-26.

Kaufman, J.; Cohn, E. and Hu, T. The Cost of Vocational and Non-Vocational Programs: A Study of Michigan Secondary Schools. University Park, PA: Pennsylvania State University, Institute for Research on Human Resources, 1975.

Kaufman, J. and Lewis, M. The Potential of Vocational Education: Observations and Conclusions. University Park, PA: Pennsylvania State University, Institute for Research on Human Resources, 1968.

Keene, T.W. "Foundation Program Cost Differentials for Community Junior Colleges." Unpublished Doctoral Dissertation, The University of Florida.

Koch, J.V. A Benefit-Cost Analysis of Vocational-Occupational Training at Selected Illinois Junior Colleges. Springfield, IL: Illinois State Advisory Council on Vocational Education, 1972.

Kraft, R.H.P. Cost-Effectiveness Analysis of Vocational-Technical Education Programs: A Pilot Study (Final Report). Tallahassee, FL: Florida State University, Educational Systems and Planning Center, 1969.

Lamb, V. "Evaluating Vocational Education Programs on the Basis of Job Placement and Labor Market Supply and Demand." Paper presented at the 1977 National Leadership Development Seminar for Administrators of Vocational Education in Large Cities, Columbus, OH, 1977.

Lee, A.M. Learning a Living Across the Nation: Project Baseline Second National Report. Flagstaff, AZ: Northern Arizona University, 1976.

Marson, A.A.; Weiner, A.E. and Sorenson, R.P. Cost Benefit Model Development. Cost-Benefit Study (Final Report). Fond du Lac, WI: Lakeshore Technical Institute and Moraine Park Technical Institute, 1978.

McKinney, F. and Harvey, B. (eds.). *Viewpoints on Interpreting Outcome Measures in Vocational Education.* Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1978.

McNelly, D.E. and Kazanas, H.C. "A Cost/Benefit Comparison of Cooperative Vocational and In-School Vocational-Technical Education Programs." *Journal of Industrial Teacher Education* 13 (Fall 1975): 62-73.

Mertens, D.M.; McElwain, D.; Garcia, G. and Whitemore, M. *The Effects of Participating in Vocational Education: Summary of Studies Reported Since 1968.* Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1980.

Mirengoff, W. *The New CETA: Effect on Public Service Employment Programs: A Preliminary Report.* Washington, DC: National Academy of Sciences, 1978.

Moayed-Dadkhah, K. *Cost Analysis of OEO-ORI Longitudinal Study of Four Manpower Programs.* Bloomington, IN: Indiana University, 1975.

Moss, J., Jr. and Stromsdorfer, E.W. "Evaluating Vocational and Technical Education Programs." *Vocational Education Today and Tomorrow.* Madison, WI: University of Wisconsin, Center for Studies in Vocational and Technical Education, 1971.

Nosow, S. *Retraining Under the Manpower Development and Training Act: A Study of Attributes of Trainees Associated With Successful Retraining.* East Lansing, MI: Michigan State University, 1970.

Nystrom, D.C. and Hennessy, J.V. "Cost Differential Analysis: Providing Data for Added Cost Funding." *Journal of Industrial Teacher Education* 13 (1975): 53-61.

Osburn, D.D. and Goishi, F. "An Analysis of Factors Influencing Costs Among Area Vocational Schools." *Journal of Industrial Teacher Education* 12 (1974): 48-56.

Osburn, D.D. and Richardson, W.B., Jr. "Cost and Benefits of Junior College Trade and Industrial Education." *Journal of Industrial Teacher Education* 12 (1974).

Parry, E.B. "An Investigation of Cost Differentials Between Trade, Technical, and College Parallel Curriculums Offered in North Carolina's System of Comprehensive Community Colleges." Unpublished Doctoral Dissertation, University of North Carolina at Chapel Hill, 1968.

Parsons, D.O. "The Cost of School Time, Foregone Earnings, and Human Capital Formation." *Journal of Political Economy* 82 (March/April 1974): 251-266.

Persons, E.A.; Swanson, G.I.; Kittleson, H.M. and Leske, G.W. *An Economic Study of the Investment Effects of Education in Agriculture* (Final Report). St. Paul, MN: University of Minnesota, Department of Agricultural Education, 1968.

Psacharopoulos, G. The Rate of Return on Investment in Education at the Regional Level. Honolulu, HI: University of Hawaii, Economic Research Center, n.d.

Raymond, R. and Sasmowitz, M. "The Returns to Investment in Higher Education: Some New Evidence." Journal of Human Resources 10 (Spring 1975): 139-154.

Ribich, T.I. and Murphy, J.L. "The Economic Returns to Increased Educational Spending." Journal of Human Resources 10 (Winter 1975): 56-77.

Richardson, W.B. "Cost-Benefit Analysis of Vocational-Technical Education Programs in Missouri Junior Colleges." Unpublished Doctoral Dissertation, University of Missouri, 1972.

Robon, N.C. "A Comparative Study of High School, Two-Year College and Four-Year College Vocational/Technical/Professional Selected Business Graduates with Regard to Their First Full-Time Job and Salary Obtained After Graduation." Paper presented at the annual forum of the Association for Institutional Research, Houston, TX, 1978.

Schriver, W.R. and Bowlby, R.L. The Effects of Vocational Training on Labor Force Experience. An Analysis of the Tennessee Area Vocational Technical School System. Memphis, TN: Memphis State University, 1971.

Sewell, D. Training the Poor: A Cost-Benefit Analysis of Manpower Programs in the U.S. Antipoverty Program. Industrial Relations Center, 1971.

Sewell, S.; Wagner, D.J. and Anderson, R.H. Descriptive Cost-Benefit Studies of Selected Wisconsin VTAE Programs. Fennimore, WI: Southwest Wisconsin Vocational-Technical Institute, 1974.

Shymoniak, L.R. "The Analysis of Costs and Effectiveness of Vocational Education in Three Selected California Community Colleges." Unpublished Doctoral Dissertation, University of California at Los Angeles, 1972.

Solomon, L.C. and Taubman, P.J. Does College Matter? Some Evidence on the Impacts of Higher Education. New York, NY: Academic Press, 1973.

Somers, G. and Little, J.K. Cost-Benefit Analysis of Manpower Policies: Proceedings of the North American Conference. Madison, WI: University of Wisconsin, 1972.

Somers, G.; Sharp, L.M. and Myint, T. The Effectivenss of Vocational and Technical Programs: A National Follow-up Survey (Final Report). Madison, WI: University of Wisconsin, Center for Studies in Vocational and Technical Education.

Somers, G. and Stromsdorfer, E.W. "A Benefit-Cost Analysis of Manpower Retraining." Proceedings of the 17th Annual Meeting of the Industrial Relations Research Association, 1965.

__________ (eds.). *Cost-Benefit Analysis Manpower Policies*. Kingston, Ontario: Queen's University, 1969.

Sparks, D. *A Synthesis of Research Findings Which Described Selected Benefits and Outcomes for Participants in Vocational Education*. Washington, DC: U.S. Office of Education, Bureau of Occupational and Adult Education, 1977.

Spiegelman, G., et al. *Cost-Benefit Model to Evaluate Programs* (Progress Report). Menlo Park, CA: Stanford Research Institute, 1967.

Stromsdorfer, E.W. *Review and Synthesis of Cost-Effectiveness Studies of Vocational and Technical Education*. Columbus, OH: Ohio State University, Center for Vocational and Technical Education, 1972.

Stromsdorfer, E.W. and Fackler, J.S. *An Economic and Institutional Analysis of the Cooperative Vocational Education Program in Dayton, Ohio*. Bloomington, IN: Indiana University, 1973.

Stromsdorfer, E.W.; Fackler, J.S.; Felton, M.V. and Kelcher, R.E. *An Economic Analysis of the Work Experience and Career Exploration Program: 1971-1972 School Year* (Final Report). Bloomington, IN: Indiana University, 1973.

Swanson, A.D. *A Study of the Costs, Benefits, and Effectiveness of Occupational Education*. Buffalo, NY: State University of New York, 1976.

A System for Analyzing the Cost of Operating Vocational Education Programs at the Secondary Level in Ohio: A Study of School Year 1973-1974. Columbus, OH: Ohio State Department of Education, 1975.

Taussig, M.K. "An Economic Analysis of Vocational Education in New York High Schools." *Journal of Human Resources* 3 (1968): 59-87.

Tempte, W. *Descriptive Cost-Benefit Study*. La Crosse, WI: Western Wisconsin Technical Institute, 1974.

Thomas, H.B. *Data-Based Locally Directed Evaluation of Vocational Education Programs, Component 2: Comparison of Program Output With Community Occupational Needs*. Tallahassee, FL: Florida State University, 1977.

Tomlinson, R.M. and Rzonca, C.S. *An Exploratory Analysis of Differential Program Costs of Selected Occupational Curricula in Selected Illinois Junior Colleges* (Final Report). Springfield, IL: Illinois State Board of Vocational Education and Rehabilitation, Vocational and Technical Educational Division, n.d.

U.S. Department of Labor. *The Cost-Benefit Analysis of Manpower Programs: Selected References*. Washington, DC: Office of the Assistant Secretary for Administration and Management, 1975.

Verden, W.A. *Rate of Return to Investment in Education at All Levels in the State of Nebraska*. Omaha, NE: University of Nebraska, 1975.

Warmbrod, J.R. Review and Synthesis of Research on the Economics of Vocational-Technical Education. Columbus, OH: Ohio State University, Center for Vocational and Technical Education, 1968.

Wattenbarger, J.L.; Cage, B.N. and Arney, L.H. The Community Junior College: Target Populations, Program Costs and Cost Differentials. Gainesville, FL: University of Florida, Institute of Higher Education, 1970.

Webb, R. Conceptual Framework for Conducting Cost-Benefit Studies in Wisconsin Vocational, Technical, and Adult Education Programs. Eau Claire, WI: Wisconsin District One Technical Institute, 1974.

Wilms, W.W. The Effectiveness of Public and Proprietary Occupational Training. Berkeley, CA: University of California, Center for Research in Higher Education, 1974.

Winter, G., et al. Reality-Based Evaluation for Two Year Community College Occupational Programs (Pilot Edition). Ithaca, NY: Cornell Institute for Research and Development in Occupational Education, 1975.

Witmer, D.R. "Cost Studies in Higher Education." Review of Educational Research 42 (Winter 1972): 99-127.

__________. "Economic Benefits of College Education." Review of Educational Research 40 (October 1970): 511-523.

VOCATIONAL EDUCATION DATA SOURCES

Bailey, S., et al. Tabular Summary of the Third Follow-Up Questionnaire Data, Volumes I-IV. Washington, DC: National Center for Education Statistics, 1978.

Brown, L. III; Barnes, R.; Currence, M. and Henderson, D. Research and Data Resources in Vocational Education: An Assessment. Washington, DC: U.S. Department of Education, Office of the Assistant Secretary for Planning and Evaluation, 1980.

Brown, L. III and Gilmartin, K.J. Measures of Participation in Vocational Education: Enrollments, Students and Exposure. Washington, DC: U.S. Department of Education, Office of Planning and Budget, Office of Technical and Analytical Systems, 1980.

Burdette, C.E. Design and Development of Fiscal and Student Follow-Up Components of the West Virginia Comprehensive Data System for Vocational Education (Final Report). Charleston, WV: West Virginia Department of Education, Bureau of Vocational, Technical and Adult Education, 1976.

Center for Human Resource Research. The National Longitudinal Surveys Handbook. Columbus, OH: Ohio State University, 1977 (revised).

Conroy, W.G. Jr. Population Sample Relationships and Data Types (Occasional Paper No. 1). Winchester, MA: Management and Information System for Occupational Education, 1972.

Creech, F.R. A Vocational Re-evaluation of the Base Year Survey of the High School Class of 1972. Part I: Selected Characteristics of the Class of 1972. Princeton, NJ: Educational Testing Service, 1974.

Drewes, D.W. and Katz, D.S. Data Needs in Vocational Education: The Development of a Minimal Information System to Satisfy the Needs of Selected User Groups (Final Report). Raleigh, NC: North Carolina State University, Center for Occupational Education, 1976.

________. Manpower Data and Vocational Education: A National Study of Availability and Use. Raleigh, NC: North Carolina State University, Center for Occupational Education, 1975.

Echternacht, G.J. A Vocational Re-evaluation of the Base Year Survey of the High School Class of 1972. Part II: Characteristics Distinguishing Vocational Students from General and Academic Students. Princeton, NJ: Educational Testing Service, 1975.

Eckland, B.K. and Bailey, J.P. National Longitudinal Study of the High School Class of 1972: Capsule Description of First Follow-up Survey Data. Durham, NC: Research Triangle Institute, Center for Educational Research and Evaluation, 1976.

Evaluation of the Occupational Training Information System (OTIS). Silver Spring, MD: Macro Systems, 1974.

Feller, B.A. Directory of Federal Agency Education Data Tapes. Washington, DC: National Center for Education Statistics, 1976.

Fetters, W.B. National Longitudinal Study of the High School Class of 1972: Student Questionnaire and Test Results by Sex, High School Program, Ethnic Category and Father's Education. Washington, DC: National Center for Education Statistics, 1975.

Field Test Results of the Management Information System for Occupational Education: Census Data System (Fall Report). Winchester, MA: Management Information System for Occupational Education, 1974.

Fine, S.A. "The Use of the Dictionary of Occupational Titles as a Source of Estimates of Educational and Training Requirements." Journal of Human Resources 3 (1968): 363-375.

Flanagan, J. and Cooley, W. Project TALENT: 1-Year Follow-up Studies. Cooperative Research Project No. 2333. Pittsburgh, PA: University of Pittsburgh, School of Education, 1966.

Flanagan, J.; Dailey, J.; Shaycoft, M.; Orr, D. and Goldberg, I. *Project Talent: A Survey and Follow-up of Educational Plans and Decisions in Relation to Aptitude Patterns - Studies of the American High School*. Cooperative Research Project Number 226, Pittsburgh, PA: University of Pittsburgh, School of Education, 1962.

Freeberg, N.E. and Rock, D.A. *A Vocational Re-evaluation of the Base Year Survey of the High School Class of 1972. Part III: Aspirations and Plans of High School Students; The Role of Academic, Social and Personal Characteristics*. Princeton, NJ: Educational Testing Service, 1975.

Garfield, I. *The Condition of Education, Part 2*. Washington, DC: National Center for Education Statistics, 1980.

Geigle, E.K. *Management Information Systems*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1978.

Ghazalah, I.A. "Economic Performance of Vocational Education Graduates: A Study Based on U.S. Individual Income Tax Data." *The Journal of Vocational Education Research* (1981): forthcoming.

Golladay, M.A. and Wulfsberg, R.M. *The Condition of Vocational Education: Review Edition*. Washington, D.C.: National Center for Education Statistics, 1980.

Grasso, J.T. and Shea, J.R. "Effects of Vocational Programs: Research Findings and Issues." *The Planning Papers for the Vocational Education Study*. Washington, DC: National Institute of Education, 1979.

The Guide to Vocational Education in America: Trends in 1978. Westport, CT: Market Data Retrieval, Inc., 1975.

Hopkins, C.O. *Data Sources for Vocational Education Evaluation*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1977.

Hulse, I. *Management Information System for Vocational Education*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1977.

Kay, E.R. *Directory of Postsecondary Schools with Occupational Programs*. Washington, DC: National Center for Education Statistics, 1978.

__________. *Enrollments and Programs in Noncollegiate Postsecondary Schools*. Washington, DC: National Center for Education Statistics, 1978.

Lee, A.M. *Data Base for Vocational Education and Manpower Training: Project Baseline*. Flagstaff, AZ: Northern Arizona University, 1974.

__________. *Use of Evaluative Data by Vocational Educators*. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

__________. "The Vocational Education Data Base." The Planning Papers for the Vocational Education Study (Vocational Education Study Number 1). H. David and G. Hendrickson, eds. Washington, DC: National Institute of Education, 1979.

Mendenhall, E.B. The Nebraska Vocational Information System (Final Report). Lincoln, NE: Nebraska Occupational Needs Research Coordinating Unit, 1977.

Morgan, R.L.; Ballenger, W.L. and Lawrence, J.E.S. Management Information Systems for Vocational Education: A National Overview. Raleigh, NC: North Carolina State University, 1974.

National Center for Education Statistics. Indicators of Educational Outcome: Fall 1972. Washington, DC: U.S. Government Printing Office, 1973.

National Study of Vocational Education Facilities and Resource Utilization. Rockville, MD: Westat, Inc., 1978.

Nerden, J.T., et al. "The Development of a Minimal Information System to Satisfy the Needs of Selected User Groups." Data Needs in Vocational Education, Volume III (Final Report). Raleigh, NC: North Carolina State University, 1976.

O'Malley, P.M.; Bachman, J.G. and Johnston, J. Five Years Beyond High School: Causes and Consequences of Educational Attainment. Ann Arbor, MI: University of Michigan, Survey Research Center, 1977.

Pargament, R. The Coordination of a Program Planning and Evaluation System for Occupational Education, Vol. 1: A Layman's Guide to the Reporting and Evaluation System for Occupational Education. New York, NY: Riverside Research Trust, 1973.

Parnes, H.S., et al. Career Thresholds: A Longitudinal Study of the Educational and Labor Market Experience of Male Youth, Volume 2. Washington, DC: U.S. Department of Labor, Manpower Administration, 1971.

Peng, S.; Stafford, C. and Talbert, R. National Longitudinal Study of the High School Class of 1972: Review and Annotation of Study Reports. Durham, NC: Center for Educational Research and Evaluation, 1977.

Pucell, D.J. Longitudinal Methods as Tools for Evaluating Vocational Education. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

__________. The Minnesota Vocational Follow-Up System: Rationale and Methods. Minneapolis, MN: University of Minnesota, Department of Industrial Education, 1973.

Putnam, J.F. Student/Pupil Accounting: Standard Terminology and Guide for Managing Student Data in Elementary and Secondary Schools, Community/Junior Colleges, and Adult Education. Washington, DC: National Center for Education Statistics, 1974 (revised).

Riendeau, A.J. "Trends in Postsecondary Vocational and Technical Education." Developing the Nation's Work Force. M. Strong, ed. Washington, DC: American Vocational Association, 1975.

Roberts, C.T. and Lichtenberger, A.R. Financial Accounting: Classifications and Standard Terminology for Local and State School Systems, Handbook II (revised). Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1973.

Starr, H.; Black, M.S. and Gray, K.E. Management Information Systems for Vocational Education: A National Study. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1977.

Steele, M. Women in Vocational Education. Flagstaff, AZ: Northern Arizona University, Project Baseline, 1974.

Tabler, K.A. NLS-1972: Tabular Summary of First Follow-Up Questionnaire Data. Washington, DC: U.S. Government Printing Office, 1976.

U.S. Department of Commerce, Bureau of the Census. Census of Population, 1970. Subject Reports: Educational Attainment. Washington, DC: U.S. Government Printing Office, 1973.

U.S. Department of Commerce, Bureau of the Census. Vocational School Experiences: October 1976. Washington, DC: U.S. Government Printing Office, 1979.

U.S. Department of Commerce, Bureau of Economic Analysis. Area Economic Projections: 1990. Washington, DC: U.S. Government Printing Office, n.d.

U.S. Department of Health, Education, and Welfare, Office of Education. Cooperative Education Award Booklet. Washington, DC: U.S. Government Printing Office, 1975.

U.S. Department of Health, Education, and Welfare, Office of Education. Summary Data on Vocational Education, Fiscal Year 1972. Washington, DC: U.S. Government Printing Office, 1973.

U.S. Department of Health, Education, and Welfare, Office of Education. Summary Data of Vocational Education, Fiscal Year 1976. Washington, DC: U.S. Government Printing Office, 1976.

U.S. Department of Health, Education, and Welfare, Office of Education. Vocational and Technical Education: Selected Statistical Tables, Fiscal Year 1975. Washington, DC: 1976.

U.S. Department of Labor, Bureau of Labor Statistics. Occupational Projections and Training Data. Washington, DC: U.S. Government Printing Office, 1976.

U.S. Department of Labor, Employment and Training Administration. Employment and Training Report of the President. Washington, DC: U.S. Government Printing Office, 1977.

U.S. Department of Labor, Employment and Training Administration. The Labor Market Information System of the Employment and Training Administration. Washington, DC: Government Printing Office, 1976.

Vatz, D.S. Data Availability in Vocational Education, Vol. IV: Alternative Procedures for Meeting Informational Needs. Raleigh, NC: North Carolina State University, Center for Occupational Education, 1976.

Wise, L.; McLaughlin, D. and Steel, L. The Project Talent Data Bank Handbook. Palo Alto, CA: American Institutes for Research, 1977.

Woods, E.M. "National Longitudinal Studies and Data Sets." VocEd 55 (September 1980): 35-38, 63.

Wulfsberg, R.M. A Statistical Overview of Vocational Education. Washington, DC: National Center for Education Statistics, 1980.

APPENDIX C
GLOSSARY

Adult Education - Basic instruction for adults that may be provided by a school system, college, or other institution but is usually apart from the regular matriculating program. Adult education courses are taken solely for personal enrichment.

Adult Vocational Education - Specially established courses teaching job skills that are developed to meet the specific occupational or manpower needs of a community or an employer. Adult vocational courses may be offered in either secondary or postsecondary institutions.

Area Vocational School - A public school approved by a State Board of Vocational Education to provide occupational training to residents of the state, county, city, or other geographic area usually larger than the local basic administrative unit.

Average Cost - The total cost of a program divided by the number of units produced or consumed.

Average Daily Attendance (ADA) - The sum of each day's attendance during the school year divided by the total number of school days.

Average Daily Membership (ADM) - The sum of each day's enrollment during the school year divided by the total number of school days.

Benefit - A consequence or outcome of the educational process measured in monetary or non-pecuniary terms.

Capital Costs - Costs incurred for the purchase of capital equipment (e.g., machinery, buildings, etc.)

Career Education - Planned education experiences by which one prepares for a career.

Community College - A postsecondary institution offering two year matriculating programs in both general and vocational education.

Comprehensive High School - A secondary school offering diversified curricula including academic, general, and vocational programs. The vocational offerings in a comprehensive high school are more diverse and extensive than in a general high school.

Consumption - The use of resources purely for immediate personal gratification and not for future income gains.

Cooperative Education - A combined program of school instruction and on-the-job training.

Cost - A monetary or non-pecuniary unit that is incurred in obtaining an outcome or consequence.

Cost-Benefit Analysis - An analytic framework in which the cost and benefits of a project are compared.

Cost-Benefit Ratio - An analytic tool used in cost-benefit analysis which relates costs and benefits by dividing total benefits by total costs. The terms cost-benefit ratio and benefit-cost ratio are often used interchangeably.

Cost-Effectiveness Analysis - An analytic framework which relates program costs to a quantified level of effectiveness.

Direct Costs and Benefits - Costs and benefits resulting directly from participating in or conducting a program.

Discount Rate - A factor which "discounts" future earnings and costs to a present value.

Disposable Income - Total income after taxes.

Dual Enrollment - An arrangement where a student concurrently attends two schools part time such as a secondary school and an area vocational school. This is also called shared time.

Earnings - Money earned through labor rather than investments.

Earnings Multiplier Effect - The interactive chain of increased earnings that results from one individual receiving an increase in disposable income and spending part of that increase which, in turn, increases the income of another individual, etc.

Educational Inputs - Inputs used in the process of providing an education (e.g., teachers, books, buildings, etc.)

Educational Outputs - Outputs resulting from the educational process (e.g., knowledgeable students).

Externality - The result of an economic action that affects individuals (positively or negatively) not directly involved in the transaction.

Foregone Income - The potential income that is given up by an individual while attending school.

Full-Time Equivalent (FTE) - A measure of the equivalent number of full-time students in a school. It is calculated by determining the number of classroom hours for a full-time student and summing the proportions of this figure for all students.

General High School - A high school primarily teaching courses in general or academic education but also offering a limited number of vocational programs.

Holding Power - A measure of student retention represented by the percentage of students who remain in a program. Therefore, this is the inverse of the dropout rate.

Income - Money earned through labor, investments, etc.

Indirect Costs and Benefits - Costs and benefits that are an indirect result of participating in a program.

Investment - The use of resources to increase future levels of income or consumption.

Joint Costs - Costs associated with an educational input that are used by more than one student cohort group.

Longitudinal Data - Information collected on students or individuals over time.

Management Information System (MIS) - A reservoir of data that usually is accessed by computer. The system may be used to make efficient expenditure decisions or to compare the effectiveness of alternative policies.

Manpower Training - Job oriented or vocational training normally provided outside of formal school settings.

Marginal Costs - The addition to total cost of a unit increase in output.

Model - A specification of the variables that make up a functional system and the interrelationships between these variables.

Net Present Value - An analytic tool used in cost-benefit analysis that represents the difference between the present value of the benefit and cost streams.

Non-Pecuniary Costs and Benefits - Cost and benefits generally not quantifiable in monetary terms.

Opportunity Costs - The value of using an activity's inputs for an alternative purpose.

Postsecondary Vocational Education - Instructional programs provided on an ongoing basis in a post-high school setting that teach job skills to its participants.

Practical Arts - Courses in occupational subject areas that are prevocational, exploratory, and/or for personal consumption by secondary level students.

Private Benefits and Costs - Benefits and costs accruing to the student receiving educational training.

Production Function - An analytical tool that relates quantities of inputs to one or more outputs.

Productivity - A measure of output per unit of input.

Proprietary School - A private for profit school which usually offers postsecondary training in a particular occupational area.

Public Good - An item which everyone may enjoy and not be excluded from its benefits. An often-used example is national defense.

Rate of Return - A percentage calculation indicating the economic return on investment.

Regression Analysis - A statistical technique which relates a dependent variable to a group of independent variables.

Secondary Vocational Education - High school level programs that teach occupational skills and prepare a student to hold a job.

Shadow Price - The price attributed to a good or service by an evaluator when, from the viewpoint of the evaluator, the good or service is not appropriately priced, due to externalities or other market inadequacies. This is also known as accounting price.

Social Benefits and Costs - Benefits and costs accruing to society as a result of a student receiving educational training.

Student-Unit - A unit of measure generally used as the primary measure of student participation.

Technical Institute - A degree granting institution offering instruction in one or more technical fields at the postsecondary level.

Vocational Education - Education in one or more skilled, semi-skilled, or technical occupations.

Vocational High School - A high school specializing in vocational curricula while also teaching academic subjects.

Vocational Rehabilitation - The service of preparing disabled persons for employment through diagnosis, guidance, training, and placement.

APPENDIX D
LIST OF DELPHI PANELISTS

DELPHI PANEL MEMBERS

Dr. Kern Alexander
Director
Institute for Educational Finance
University of Florida
Gainesville, Florida

Dr. Don K. Gentry
State Director of Vocational Education
Indianapolis, Indiana

Dr. George Hagerty
Advocate for Vocational Career Education
Division of Personnel Preparation
U.S. Department of Education
Washington, D.C.

Dr. Charles Hopkins
Oklahoma Department of Vocational Education
Stillwater, Oklahoma

Dr. Jin Eun Kim
Assistant Professor of Educational Administration
School of Education
Catholic University of America
Washington, D.C.

Dr. Gary Meers
Director, Special Vocational Needs
The Center for Vocational Teacher Education
University of Nebraska
Lincoln, Nebraska

Dr. L. Allen Phelps
Associate Professor
Department of Vocational and Technical Education
University of Illinois
Urbana-Champaign, Illinois

Dr. Robert Thrall
Professor and Chairman
Department of Mathematical Sciences
Rice University
Houston, Texas

APPENDIX E

DELPHI SURVEY PACKAGE

Explanation of the Evaluation System for Round One
Round One Questionnaire
Round Two Questionnaire

EXPLANATION OF EVALUATION SYSTEM

The following evaluation system will be used throughout the exercise to provide possible expressions of judgment. Please keep the following guidelines in mind when responding to each question or using the descriptors in a comment. This is important in establishing comparability among responses even though the definitions may not be universally agreeable.

DESIRABILITY (Effectiveness or benefits)	
4 Very Desirable	will have a positive effect and little or no negative effect; extremely beneficial; justifiable on its own merit.
3 Desirable	will have a positive effect, negative effects are minor; beneficial; justifiable as a by-product or in conjunction with other items.
2 Undesirable	will have a negative effect; harmful; may be justified only as a by-product of a very desirable item, not justified as a by-product of a desirable item.
1 Very Undesirable	will have a major negative effect; extremely harmful; not justifiable.

FEASIBILITY (Practicality)	
4 Definitely Feasible	no hindrance to implementation; no political roadblocks; acceptable to the public.
3 Possibly Feasible	some indication this is implementable; further consideration or preparation must be given to political or public reaction.
2 Possibly Infeasible	some indication that this is unworkable; significant unanswered questions.
1 Definitely Infeasible	all indications are negative; unworkable; cannot be implemented.

DELPHI QUESTIONNAIRE

ROUND 1

for the

Design of a National Cost-Benefit
Study of Vocational Education
at the Secondary, Postsecondary,
and Adult Levels

Rehab Group, Inc.
5827 Columbia Pike
Falls Church, Virginia 22041

June 26, 1981

INSTRUCTIONS FOR DELPHI PANELISTS

(1) Enclosed are two copies of the Delphi questionnaire. Return only one in the enclosed stamped and preaddressed envelope. The second is for reference and to assist you in preparing your response.

(2) Please mail your response on or before July 7.

(3) The questionnaire is divided into three sections:

- Questions on the general design of a cost-benefit study of vocational education
- Questions concerning measurement issues and problems
- Questions on data availability

For each question, you are to evaluate the desirability and/or feasibility of every response according to an evaluation system. This evaluation system is explained on a separate sheet so that you can refer to it easily throughout the exercise. Be sure that you evaluate every response; do not merely select the one response that is most agreeable to you.

(4) You are encouraged to write justifications for your answers and general comments on the issues discussed in each question. Such comments are an important part of the information collection process. The amount of information gained from the Delphi exercise is dependent upon each respondent writing relevant comments on the questions. These comments will be made available to other panelists before they respond to the second round questionnaire. Anonymity will be maintained in all cases. The right hand page opposite each question is blank so that you can easily write your comments. Feel free to attach additional sheets, if necessary.

(5) Questions in this Delphi exercise are meant to be a stimulus for thought on the feasibility of performing a national cost-benefit analysis of vocational education. You should not feel constrained by the questions. In fact, you have the following options on any question:

- Rewrite the question and answer your version if you feel the original is misleading or inappropriate.
- Suggest questions you would like to see in the next round of the exercise that you feel will clarify an issue or raise a new alternative that the Delphi panelists should consider.
- Write comments that relate to the question or that clarify your response to the question.

(6) In subsequent rounds, additional questions will be developed that attempt to highlight reasons why polarization of viewpoints occurred on some issues. Also, new questions will be added or old questions reworded to clarify viewpoints. Therefore, the Delphi process is a cumulative one.

(7) Thank you again for your commitment to this exercise. We look forward to your response. If you have any questions, feel free to call Dr. Mark Shugoll or Mr. Tim Helms collect at (703) 820-4350.

I. QUESTIONS ON GENERAL STUDY DESIGN

The following questions deal with general issues in the design of a national cost-benefit study of vocational education.

1. A national cost-benefit study of vocational education must be designed to meet the needs of its users. Please evaluate the desirability and feasibility of designing a study which would yield information to meet the needs of the following user groups:

	Desirability	Feasibility
- *Individuals*, whose needs might include determining whether vocational training will result in increased future benefits		
- *Educational institutions*, whose needs might include making efficient investment decisions		
- *Local education agencies*, whose needs might include making program decisions based on local manpower needs		
- *State education agencies*, whose needs might include determining how to distribute educational revenues to maximize educational output		
- *Federal Government*, whose needs might include allocating scarce resources among alternative programs		
- Other (please specify)		

COMMENTS

1.

2. Please evaluate the desirability and feasibility of each of the following possibilities in designing a national cost-benefit study of vocational education:

	Desirability	Feasibility
- Narrow the focus of the study to a single user and construct a compact model		
- Develop a broad and versatile model that would provide results that are meaningful to many or all potential users		
- Construct several models that separately address the information needs of different users		

3. Please evaluate the desirability of each of the following considerations in designing a national cost-benefit study of vocational education:

	Desirability
- Study design should be dictated by the current availability of data	
- Study design should be dictated by model construct capabilities	
- Study design should be dictated by cost considerations	

COMMENTS

2.

3.

4. The scope of a national cost-benefit evaluation is of particular concern. The larger the scope, the more generalizable are the results. However, the larger the scope, the less specific are the results concerning educational level and program area.

a. Please evaluate the desirability and feasibility of conducting a national cost-benefit study of the following educational levels:

	Desirability	Feasibility
- An aggregation of secondary, postsecondary, and adult vocational education programs		
- An examination of secondary vocational education programs only		
- An examination of postsecondary vocational education programs only		
- An examination of adult vocational education programs only		

b. For any given educational level, please evaluate the desirability and feasibility of conducting a national cost-benefit study which:

	Desirability	Feasibility
- Does not distinguish among program areas or specific programs		
- Distinguishes among broad program areas only		
- Distinguishes among specific programs within broad program areas		

c. For any given educational level and program area, please evaluate the desirability and feasibility of conducting a national cost-benefit study which distinguishes between the type of institution in which the training is received (e.g., community colleges, technical institutes, proprietary schools, on the job training, etc.):

Desirability	Feasibility

COMMENTS

4. a.

b.

c.

II. QUESTIONS ON MEASUREMENT ISSUES

Numerous measurement problems will confront a study team performing a national cost-benefit analysis of vocational education. The following questions present some of the concepts that may result in measurement problems.

1. One of the first problems encountered when considering a cost-benefit analysis is to determine who is a vocational education student. Please evaluate the desirability and feasibility of using the following criteria for determining a vocational education program participant:

	Desirability	Feasibility
- Enrollment in at least one vocational class		
- Enrollment in more than one vocational class		
- Enrollment in a fixed series of related vocational classes		
- Other (please specify)		

2. Once an appropriate determination has been made on what determines a vocational education program participant, a suitable method for counting these students needs to be determined. Please evaluate the desirability and feasibility of using the following measures of student participation:

	Desirability	Feasibility
- Average Daily Attendance (ADA)		
- Average Daily Membership (ADM)		
- (ADA + ADM)/2		
- Full-time Equivalent (FTE)		
- Other (please specify)		

COMMENTS

1.

2.

3. The costs and benefits resulting from vocational education need to be compared to those of one or more alternative activities. Those comparison activities may differ by educational level.

   a. Please evaluate the desirability and feasibility of comparing the costs and benefits of secondary vocational education with the costs and benefits of:

	Desirability	Feasibility
- Attending a general education program		
- Attending a college preparatory program		
- Not attending secondary school		
- A weighted average of the three previously mentioned activities		
- Other (please specify)		

   b. Please evaluate the desirability and feasibility of comparing the costs and benefits of postsecondary vocational education with the costs and benefits of:

	Desirability	Feasibility
- Attending a two-year general curriculum college		
- Attending a four-year general curriculum college		
- Not attending a postsecondary school		
- A weighted average of the three previously mentioned activities		
- Other (please specify)		

COMMENTS

3. a.

b.

3. c. Please evaluate the desirability and feasibility of comparing the costs and benefits of adult vocational education with the costs and benefits of:

	Desirability	Feasibility
- Attending a two-year general curriculum college		
- Attending a four-year general curriculum college		
- Not attending school		
- A weighted average of the three previously mentioned activities		
- Other (please specify)		

4. The costs and benefits of vocational education accrue to various individuals and groups. An essential consideration for any cost-benefit calculation is to determine for which entity (i.e. an individual or society as a whole) costs and benefits should be evaluated in a national study. Please rate the desirability and feasibility of evaluating the cost and benefits accruing to the following:

	Desirability	Feasibility
- The vocational education enrollee		
- Society as a whole (including the enrollee)		
- Society exclusive of the vocational enrollee		
- Other (please specify)		

COMMENTS

3. c.

4.

5. A discount rate is often utilized in cost benefit analysis to equate future income with present values. Please rate the desirability of using the following measures as a discount rate:

	Desirability
- The prime rate of interest	
- The rate of interest on government treasury bills	
- The rate of inflation	
- Zero (discount rates should not be included in the study)	
- Other (please specify)	

6. The allocation of "joint costs" presents a problem for cost-benefit evaluators. Joint costs occur when an educational input, such as a teacher, piece of equipment, or school building, is used by more than one student group. Please rate the desirability and feasibility of the following treatments of joint cost:

	Desirability	Feasibility
- Exclude from analysis		
- Evaluate the marginal cost of use		
- Evaluate the average cost of use		
- Other (please specify)		

COMMENTS

5.

6.

7. The opportunity cost of attending a vocational education program may enter in as one of the largest cost components in a cost-benefit analysis. An opportunity cost is the income a student would have earned had he/she been working rather than attending school. The appropriate estimator of income foregone may differ by program level. Please rate the desirability and feasibility of the following estimators of foregone income for the secondary, postsecondary, and adult vocational education levels.

   a. For secondary vocational education, the appropriate estimator of the opportunity cost of attendance might be:

	Desirability	Feasibility
- Zero, the individual would be attending school anyway		
- The average income of individuals of high school age who are not attending school		
- A weighted average of the two previous measures		
- Other (please specify)		

   b. For postsecondary vocational education, the appropriate estimator of the opportunity cost of attendance might be:

	Desirability	Feasibility
- Zero, the student would be attending school anyway		
- The average earnings of individuals of similar characteristics who are not attending school		
- A weighted average of the previous two estimators		
- Other (please specify)		

COMMENTS

7. a.

b.

7. c. For adult vocational education, the appropriate estimator of the opportunity cost of attendance might be:

	Desirability	Feasibility
- Zero, the student would be attending school anyway		
- The average earnings of individuals of similar characteristics who are not attending school		
- A weighted average of the two previous estimators		
- Other (please specify)		

8. Please evaluate the desirability and feasibility of utilizing the following measures of future earnings:

	Desirability	Feasibility
- Gross income (including investments)		
- Annual labor earnings		
- Individual hourly wage rates		
- Other (please specify)		

COMMENTS

---

7. c.

8.

9. Increased earnings resulting to a vocational education graduate have an economic impact greater than the net increase in the graduates' earnings. This results because a large portion of the increased earnings will typically be spent, increasing the income of another individual. Please rate the desirability and feasibility in a national cost-benefit study of accounting for this earnings multiplier effect.

Desirability	Feasibility

10. Please evaluate the desirability and feasibility of including non-pecuniary costs and benefits in a cost-benefit analysis.

Desirability	Feasibility

COMMENTS

9.

10.

11. Please evaluate the desirability and feasibility of including measures of the differences in quality of vocational programs in a national cost-benefit analysis.

Desirability	Feasibility

12. A student may be enrolled in vocational education for both investment and consumption reasons. It is part investment because a student is investing in "human capital" with the anticipation of future increases in income. It is part consumption since a student is consuming vocational education purely for immediate personal gratification. Evaluate the desirability and feasibility of measuring consumption benefits of vocational education in a cost-benefit study.

Desirability	Feasibility

COMMENTS

11.

12.

III. QUESTIONS ON DATA AVAILABILITY

There are several sources of data that can be used in a national cost-benefit study of vocational education. The following questions consider some of these alternatives.

1. Please evaluate the desirability and feasibility of utilizing the following types of data in a national cost-benefit analysis of vocational education:

	Desirability	Feasibility
- Existing data bases		
- Existing data bases supplemented by survey data		
- Survey data collected exclusively for the cost-benefit study		

2. Please evaluate the desirability and feasibility of using the following data bases in a national cost-benefit study:

	Desirability	Feasibility	Not Familiar With Data Base
- National Center for Educational Statistics' (NCES) Vocational Education Data System (VEDS)			
- Bureau of Occupational and Adult Education's (BOAE) Statistical Reports, 1973-1978			
- NCES' High School and Beyond Longitudinal Survey (1980)			
- Department of Labor's (DOL) National Longitudinal Survey (1979)			
- NCES' National Longitudinal Survey of the High School Class of 1972			
- National Institute of Education's (NIE) Survey of Vocational Schools in Ten States (1980)			

COMMENTS

1.

2.

2. (cont'd.)

	Desirability	Feasibility	Not Familiar With Data Base
- NCES' Survey of Noncollegiate Postsecondary Students and Schools (1972-1980)			
- Assistant Secretary for Planning and Evaluation's (ASPE) Survey of Vocational Education Students and Teachers (1972)			
- Office of Civil Rights' (OCR) Survey of Vocational Education Schools (1979)			
- Office of Education's (OE) "437 Files" (Grants and Expenditures under State Administered Programs)			
- Census Bureau's Current Population Survey Supplement			
- Project Talent Data Base			
- NCES' Survey of Course Offerings and Enrollments (1973)			
- Survey Research Center's Youth in Transition Data Base (1966)			

COMMENTS

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2. (cont'd.)

DELPHI QUESTIONNAIRE

ROUND 2

for the

Design of a National Cost-Benefit Study of Vocational Education at the Secondary, Postsecondary, and Adult Levels

Rehab Group, Inc.
5827 Columbia Pike
Falls Church, Virginia 22041

July 17, 1981

INSTRUCTIONS FOR DELPHI PANELISTS

(1) Enclosed are two copies of the Delphi questionnaire. Return only one in the enclosed stamped and preaddressed envelope. The second is for referenece and to assist you in preparing your response.

(2) Please mail your response on or before July 29.

(3) The questionnaire is divided into three sections:

- Section I - Questions on the general design of a cost-benefit study of vocational education.
- Section II - Questions concerning measurement issues and problems.
- Section III - Miscellaneous questions.

For all questions in Sections I and II, please rank the desirability of each response in order of personal preference. Use the number 1 to designate the "most desirable" response, the number 2 to designate the "next most desirable" response, etc., until all responses are ranked. Please break all ties between rankings. Therefore, no two responses should be assigned the same number.

Example: Please rank, in order of preference, the desirability of using the following measures to end the baseball strike:

	Ranking
-- Continue present negotiations between both parties	______
-- Send the parties to binding arbitration	______
-- Place all negotiators in a boxing ring with Sugar Ray Leonard	______

Instructions for responding to questions in Section III are included with these questions.

(4) For all questions, please write a brief justification of your response on the right hand page opposite the question. This step is a critical part of the information collection process.

(5) Questions in this Delphi exercise are meant to be a stimulus for thought on the feasibility of performing a national cost-benefit analysis of vocational education. You should not feel constrained by the questions. In fact, you have the following options on any question:

- Rewrite the question and answer your version if you feel the original is misleading or inappropriate.
- Suggest questions you would like to see in the next round of the exercise that you feel will clarify an issue or raise a new alternative that the Delphi panelists should consider.
- Write comments that relate to the question or that clarify your response to the question.

The right hand page opposite each question is blank so that you can easily write your comments. All comments and justifications will be made available to other panelists before the Washington meeting. Anonymity will be maintained in all cases.

(6) Thank you again for your commitment to this exercise. We look forward to your response. If you have any questions, feel free to call Dr. Mark Shugoll or Mr. Tim Helms collect at (703) 820-4350

I. QUESTIONS ON GENERAL STUDY DESIGN

The following questions deal with general issues in the design of a national cost-benefit study of vocational education.

1. A national cost-benefit study of vocational education must be designed to meet the needs of its users. Please rank,in order of preference, the desirability of designing a study which would yield information to meet the needs of the following user groups:

Ranking

-- Individuals, whose needs might include determining whether vocational training will result in increased income, career advancement, or other benefits ______

-- Educational institutions, whose needs might include increasing the efficiency of vocational programs ______

-- Local education agencies, whose needs might include securing efficient investments in vocational programs ______

-- State education agencies, whose needs might include determining how to distribute educational revenues to maximize educational output ______

-- Federal Government, whose needs might include allocating federal funds to the most efficient alternative programs ______

-- Other (please specify) ______

COMMENTS AND JUSTIFICATIONS

1.

2. Please rank, in order of preference, the desirability of each of the following possibilities in designing a national cost-benefit study of vocational education:

Ranking

-- Narrow the focus of the study to a single user and construct a compact model ______

-- Develop a broad and versatile model that would provide results that are meaningful to many or all potential users and on diverse programs ______

-- Construct several models that separately address the information needs of different users and the characteristics of different programs ______

3. Please rank, in order of preference, the desirability of each of the following considerations in designing a national cost-benefit study of vocational education:

Ranking

-- Study design should be dictated by the current availability of data ______

-- Study design should be dictated by model construct capabilities ______

-- Study design should be dictated by cost considerations ______

COMMENTS AND JUSTIFICATIONS

2.

3.

4. The scope of a national cost-benefit evaluation is of particular concern. The larger the scope, the more generalizable are the results. However, the larger the scope, the less specific are the results concerning educational level and program area. Please rank, in order of preference, the desirability of conducting a national cost-benefit study of the following educational levels:

	Ranking
-- An examination of secondary vocational education programs only	______
-- An examination of postsecondary vocational education programs only	______
-- An examination of adult vocational education programs only	______
-- An aggregated examination of secondary, postsecondary, and adult vocational education programs	______
-- An examination of secondary, postsecondary, and adult vocational education programs with each level analyzed separately	______

COMMENTS AND JUSTIFICATIONS

4.

II. QUESTIONS ON MEASUREMENT ISSUES

Numerous measurement problems will confront a study team performing a national cost-benefit analysis of vocational education. The following questions present some of the concepts that may result in measurement problems.

1. One of the first problems encountered when considering a cost-benefit analysis is to determine who is a vocational education student. Please rank, in order of preference, the desirability of using the following criteria for determining a vocational education program participant:

	Ranking
-- Enrollment in at least one vocational class	______
-- Enrollment in more than one vocational class	______
-- Enrollment in a fixed series of related vocational classes	______
-- A combination of the above three measures	______
-- Other (please specify)	______

2. Once an appropriate determination has been made on what determines a vocational education program participant, a suitable method for counting these students needs to be determined. Please rank, in order of preference, the desirability of using the following measures of student participation:

	Ranking
-- Average Daily Attendance (ADA)	______
-- Average Daily Membership (ADM)	______
-- (ADA + ADM)/2	______
-- Full-time Equivalent (FTE)	______
-- Other (please specify)	______

COMMENTS AND JUSTIFICATIONS

1.

2.

3. The costs and benefits resulting from vocational education need to be compared to those of one or more alternative activities. Those comparison activities may differ by educational level.

   a. Please rank, in order of preference, the desirability of comparing the costs and benefits of secondary vocational education with the costs and benefits of:

      Ranking

      -- Attending a general education program ______
      -- Attending a college preparatory program ______
      -- Not attending secondary school ______
      -- A weighted average of the three previously mentioned activities ______
      -- Other (please specify) ______

   b. Please rank, in order of preference, the desirability of comparing the costs and benefits of postsecondary vocational education with the costs and benefits of:

      Ranking

      -- Attending a two-year general curriculum college ______
      -- Attending a four-year general curriculum college ______
      -- Not attending a postsecondary school ______
      -- A weighted average of the three previously mentioned activities ______
      -- Other (please specify) ______

COMMENTS AND JUSTIFICATIONS

3. a.

b.

4. The costs and benefits of vocational education accrue to various individuals and groups. An essential consideration for any cost-benefit calculation is to determine for which entity (i.e. an individual or society as a whole) costs and benefits should be evaluated in a national study. Please rank,in order of preference, the desirability of evaluating the cost and benefits accruing to the following:

	Ranking
-- The vocational education enrollee	______
-- Society as a whole (including the enrollee)	______
-- Society exclusive of the vocational enrollee	______
-- Other (please specify)	______

5. The allocation of "joint costs" presents a problem for cost-benefit evaluators. Joint costs occur when an educational input, such as a teacher, piece of equipment, or school building, is used by more than one student group. Please rank,in order of preference, the desirability of the following treatments of joint cost:

	Ranking
-- Exclude from analysis	______
-- Evaluate the marginal cost of use	______
-- Evaluate the average cost of use	______
-- Evaluate using game theory	______
-- Other (please specify)	______

COMMENTS AND JUSTIFICATIONS

4.

5.

III. MISCELLANEOUS QUESTIONS

The following questions are designed to allow panelists input in suggesting issues and questions that they feel are important in designing a national cost-benefit study of vocational education.

1. Please list what you consider to be the two major obstacles to performing a national cost-benefit analysis of vocational education:

   Obstacle I --

   Obstacle II --

COMMENTS AND JUSTIFICATIONS

1.

2. Briefly describe a strategy for overcoming, minimizing, or dealing with each obstacle listed in response to the previous question.

Obstacle I --

Obstacle II --

COMMENTS AND JUSTIFICATIONS

2.

3. Please write two questions that you feel must be addressed by a research team in designing a national cost-benefit analysis of vocational education.

These questions can deal with measurement problems, study methodology, user groups, data availability, or any other issue of your choice as long as it has not been asked previously in this questionnaire. You do not have to answer the questions.

Question I --

Questions II --

COMMENTS AND JUSTIFICATIONS

3.

APPENDIX F

RESULTS OF DELPHI ANALYSIS AND PANELISTS' COMMENTS

ROUND ONE

I. QUESTIONS ON GENERAL STUDY DESIGN

The following questions deal with general issues in the design of a national cost-benefit study of vocational education.

1. A national cost-benefit study of vocational education must be designed to meet the needs of its users. Please evaluate the desirability and feasibility of designing a study which would yield information to meet the needs of the following user groups:

	Desirability				Feasibility				
	4	3	2	1	4	3	2	1	Rating
- Individuals, whose needs might include determining whether vocational training will result in increased future benefits	3	4			2	2	3		N*
- Educational institutions, whose needs might include making efficient investment decisions	5	2			2	5			N
- Local education agencies, whose needs might include making program decisions based on local manpower needs	5	2			1	6			N
- State education agencies, whose needs might include determining how to distribute educational revenues to maximize educational output	6	1			2	5			N
- Federal Government, whose needs might include allocating scarce resources among alternative programs	5	1	1		2	4	1		N
- Special needs populations	1					1			N

---

*N = the number of panelists responding in this category

COMMENTS ON SECTION I -- QUESTION 1

-- The proposed scale is not fine enough for my taste, so I will use + to indicate halfway between. (STUDY TEAM NOTE -- FOR EASE OF PRESENTATION TO OTHER PANELISTS, A RESPONSE OF 3+ IS TABULATED AS A 3, ETC.)

-- Given the current political climate, it appears certain that local and state agencies will have the most critical policy decisions to make over the next 4-5 years relative to vocational education.

-- The feasibility of designing a cost-benefit system which effectively measures the non-economic benefits of vocational education remains doubtful in my mind.

-- Individuals may be interested in "personal" (private) costs and benefits in either advancing job oportunity or in changing their career.

-- Educational institutions may be interested in "program" costs and benefits in increasing the efficiency of vocational programs; the resulting information will be useful for program evaluation purposes.

-- Local education agencies may be interested in "public" costs and benefits in order to secure public investment in vocational programs.

-- Must avoid duplication.

-- Cost data at the best point of usage should be enough.

-- Considerable effort will have to be made to identify and measure benefits derived from vocational education. Previous studies have been conducted but with little acceptance or agreement among users.

-- Considering the economic conditions which prevail and impact upon educational decision makers, it is imperative that a national cost/benefit study address the needs of all users - from the perspective of the individual through the federal arena. Clearly, the compelling needs of special populations (i.e., handicapped, other traditionally excluded or underepresented minorities) and the efficacy of vocational education in meeting their unique needs should be an area of study. Current studies at the University of Illinois (Kush, 1980) have clearly indicated the monetary and non-monetary benefits of vocational preparation upon some of the most severely handicapped populations.

2. Please evaluate the desirability and feasibility of each of the following possibilities in designing a national cost-benefit study of vocational education:

	Desirability				Feasibility				
	4	3	2	1	4	3	2	1	Rating
- Narrow the focus of the study to a single user and construct a compact model		4	3		2	4	1		N
- Develop a broad and versatile model that would provide results that are meaningful to many or all potential users	3	2	2		2	3	2		N
- Construct several models that separately address the information needs of different users	3	3	1		3	4			N

3. Please evaluate the desirability of each of the following considerations in designing a national cost-benefit study of vocational education:

	Desirability				
	4	3	2	1	Rating
- Study design should be dictated by the current availability of data	1	4	2		N
- Study design should be dictated by model construct capabilities	3	3	1		N
- Study design should be dictated by cost considerations	1	2	2	1	N

COMMENTS ON SECTION I -- QUESTION 2

-- Would you focus the study efforts to "programs," not to "users" ?

-- Would you attempt to develop an overall framework and submodels for defining sub-components of the general model?

-- By breaking the study into consumer groups, the researchers will gain both depth and breadth in the study.

Example - Handicapped
Disadvantaged
Displaced Homemakers
High school dropouts
Etc.

-- By "several models", I would hope that you are considering 2-4 models that might be focused on type of delivery system, e.g. comprehensive high school, area vocational center, community college.

-- A broad general model can be used as a starting point for specifications to meet particular needs and interests. Moreover, construction of a narrowly focused model may be better achieved by specification of a general one (top down) by ad hoc construction (bottom up).

-- May be justified only as a by-product of a very desirable multi-model design (Option 1.)

-- Low feasibility assessment resulting from the complexity of several interdependent processes/procedures (i.e., instrument development, defining parameters of study workscope and content, and data collection and synthesis) (Option 2).

COMMENTS ON SECTION I -- QUESTION 3

-- These are all important considerations, and they are in obvious conflict. Some trade-offs will be required; I regard none of them as pre-emptive relative to the others.

-- All three factors/considerations should be given equal consideration.

-- Should set the stage for future repeats of study, not get locked into a current situation which might produce bad or unreliable data.

4. The scope of a national cost-benefit evaluation is of particular concern. The larger the scope, the more generalizable are the results. However, the larger the scope, the less specific are the results concerning educational level and program area.

a. Please evaluate the desirability and feasibility of conducting a national cost-benefit study of the following educational levels:

	Desirability				Feasibility				Rating
	4	3	2	1	4	3	2	1	
- An aggregation of secondary, postsecondary, and adult vocational education programs	3	1	1	1	2	3		1	N
- An examination of secondary vocational education programs only	3	2	1	1	4	2		1	N
- An examination of postsecondary vocational education programs only	3	2	1	1	4	2		1	N
- An examination of adult vocational education programs only	3	2	1	1	4	2		1	N

b. For any given educational level, please evaluate the desirability and feasibility of conducting a national cost-benefit study which:

	Desirability				Feasibility				Rating
	4	3	2	1	4	3	2	1	
- Does not distinguish among program areas or specific programs		1	3	2	2	2	2		N
- Distinguishes among broad program areas only		5	1	1	2	5			N
- Distinguishes among specific programs within broad program areas	4	2	1	1	1	2	4		N

c. For any given educational level and program area, please evaluate the desirability and feasibility of conducting a national cost-benefit study which distinguishes between the type of institution in which the training is received (e.g., community colleges, technical institutes, proprietary schools, on the job training, etc.):

Desirability				Feasibility				
4	3	2	1	4	3	2	1	
5	1		1	2	4		1	N

COMMENTS ON SECTION I -- QUESTION 4 a.

- You may conduct a study on costs and benefits of vocational programs by:
  - (1) school level -- secondary, post-secondary, adult.
  - (2) scope of area -- institutional basis, local basis, state-wide and/or nationwide study.
  - (3) program area and/or specific program.
- If the programs are looked at separately, and then as a part of the total program delivery model, the study will be much stronger.
- The "aggregation" need not be an "integrated aggregation" although that would be desirable if feasible.
- Each of the levels should be conducted if an attempt is made.
- Should be a total - all level - but not aggregated.
- I would encourage a cross-study analysis of relative cost-benefit measures across several management and program content variables including promising strategies which lead to effective program implementation and efficient distribution/consumption of resources.

COMMENTS ON SECTION I -- QUESTION 4 b.

-- Here is another instance where trade-offs are clearly required. The more one asks for, the harder it is to get.

-- Costs vary considerably in vocational education by specific program area. The costs for a co-op program are minimal when compared to a machine shop program.

-- The data might be easy to secure for the entire area of vocational education but its effectiveness in the field will be greatly dimished.

-- Must be defined and with some understanding among researchers and users of information from study.

COMMENTS ON SECTION I -- QUESTION 4 c.

-- This is a very important component of the study.

-- This is a must to help settle some of the arguments over whether or not secondary vocational education should exist or not.

-- Political problems -- assumes same program quality and many items.

II. QUESTIONS ON MEASUREMENT ISSUES

Numerous measurement problems will confront a study team performing a national cost-benefit analysis of vocational education. The following questions present some of the concepts that may result in measurement problems.

1. One of the first problems encountered when considering a cost-benefit analysis is to determine who is a vocational education student. Please evaluate the desirability and feasibility of using the following criteria for determining a vocational education program participant:

	Desirability				Feasibility				Rating
	4	3	2	1	4	3	2	1	
- Enrollment in at least one vocational class	3		3		2	3	1		N
- Enrollment in more than one vocational class		2	4		1	4	1		N
- Enrollment in a fixed series of related vocational classes	5	1	1		3	4			N
- Other (please specify)	2				1	1			N

2. Once an appropriate determination has been made on what determines a vocational education program participant, a suitable method for counting these students needs to be determined. Please evaluate the desirability and feasibility of using the following measures of student participation:

	Desirability				Feasibility				Rating
	4	3	2	1	4	3	2	1	
- Average Daily Attendance (ADA)	1	1	2	1	2	2		1	N
- Average Daily Membership (ADM)		1	3	1	2	2		1	N
- (ADA + ADM)/2	1		3	1	2	1	1	1	N
- Full-time Equivalent (FTE)	2	3	1		2	3			N
- Other (please specify): (Contact Hours)	1					1			N

COMMENTS ON SECTION II -- QUESTION 1

-- The feasibility varies greatly upon which state you are talking about.

-- I visualize a sampling procedure which can establish what % of "at least one" fall in each of the other categories. Then it may be possible to use one detailed measure as a surrogate for all.

-- Should be a vocational program not length of time as a class. Various occupations take different times, comparison will not be easy, but on a cost study should look at the cost of the product produced not just one segment or part of it.

-- Other: specifically designed curriculum.

COMMENTS ON SECTION II -- QUESTION 2

-- Since some funding depends on ADA, it should be measured. Since costs relate to ADM, it also needs measurement and the average seems a good statistic. However, FTE is perhaps a better output measure.

-- The researcher might well want to use a span of time as a determinant. If a student spends 15 hours or over in a vocational class they would be considered full time students.

3. The costs and benefits resulting from vocational education need to be compared to those of one or more alternative activities. Those comparison activities may differ by educational level.

   a. Please evaluate the desirability and feasibility of comparing the costs and benefits of secondary vocational education with the costs and benefits of:

	Desirability				Feasibility				
	4	3	2	1	4	3	2	1	Rating
- Attending a general education program	3	1	1	2	3	1	1	2	N
- Attending a college preparatory program	3	1	1	2	3	1	1	2	N
- Not attending secondary school	3	1	1	2	3		2	2	N
- A weighted average of the three previously mentioned activities	1	1	1	3	1	1	2	2	N
- Those special needs students attending special education programs		1				1			
- Entering an occupation without any training		1				1			N

   b. Please evaluate the desirability and feasibility of comparing the costs and benefits of postsecondary vocational education with the costs and benefits of:

	Desirability				Feasibility				
	4	3	2	1	4	3	2	1	Rating
- Attending a two-year general curriculum college	3	2		2	3	2		2	N
- Attending a four-year general curriculum college	1	2	1	3	1	2	2	2	N
- Not attending a postsecondary school	4		1	2	3	1	1	2	N
- A weighted average of the three previously mentioned activities	1	1	1	3	1	1	2	2	N
- Entering an occupation without any training		1				1			N

COMMENTS ON SECTION II -- QUESTION 3 a.

-- The largest problem with both A and B will be the securing of the data, especially for those youth who are out of school.

-- Major definitional problems exist with determination of general and college preparation curriculum students.

-- Here again, the use of a weighted average may provide a good statistic, especially if supported with data on the three alternatives.

-- I don't believe there is any reason to compare with other types of education. They all have different goals and expected outcomes. Maybe compare to training costs in other delivery systems.

-- We should never make a comparison or claim of vocational education vs. other education without consideration of goals of individuals and all the variables that may enter into picture - i.e., aptitude, what if on the same individual, 1 vs. 2 vs. 3, etc.

-- Other: Those special needs (handicapped) students attending special education programs.

COMMENTS ON SECTION II -- QUESTION 3 b.

-- For special needs populations: Potential discussion of the costs and benefits of integrated postsecondary vocational education versus segregated rehabilitation programming.

3. c. Please evaluate the desirability and feasibility of comparing the costs and benefits of adult vocational education with the costs and benefits of:

	Desirability				Feasibility				
	4	3	2	1	4	3	2	1	Rating
- Attending a two-year general curriculum college	1	1	2	3	1	2	1	3	N
- Attending a four-year general curriculum college	1	1	2	3	1	2	1	3	N
- Not attending school	3	1	1	2	2	1	2	2	N
- A weighted average of the three previously mentioned activities	1		3	2	1	1	2	2	N
- Entering an occupation without any training		1				1			N

4. The costs and benefits of vocational education accrue to various individuals and groups. An essential consideration for any cost-benefit calculation is to determine for which entity (i.e. an individual or society as a whole) costs and benefits should be evaluated in a national study. Please rate the desirability and feasibility of evaluating the cost and benefits accruing to the following:

	Desirability				Feasibility				
	4	3	2	1	4	3	2	1	Rating
- The vocational education enrollee	5	1			3	3			N
- Society as a whole (including the enrollee)	4	2			2	4			N
- Society exclusive of the vocational enrollee	3		2	1	2	2		2	N
- Special populations including: rural urban, bilingual and handicapped populations	1				1				N

COMMENTS ON SECTION II -- QUESTION 3 c.

-- Is this at the individual or at the societal level or both?

-- The data for adult vocational students will have to be secured from other sources than those used with Secondary and Postsecondary students. This statement is made because the needs of adults and their motivation for attending is so different.

COMMENTS ON SECTION II -- QUESTION 4

-- Perhaps it will be more broadly or alternately defined in the years ahead, but vocational education, in some form, will continue to exist.

-- Other: Potential for cost/benefit analysis for special populations including rural, urban, bilingual and handicapped populations.

-- I believe the benefit to society should be determined as well as the enrollee, but the costs are a different question. The costs are weights against the benefits.

5. A discount rate is often utilized in cost benefit analysis to equate future income with present values. Please rate the desirability of using the following measures as a discount rate:

	Desirability 4	3	2	1	Rating
- The prime rate of interest		2	4	1	N
- The rate of interest on government treasury bills		1	2	2	N
- The rate of inflation	2	3	1	1	N
- Zero (discount rates should not be included in the study)	1	3		3	N
- Other (please specify) (social discount rate)	1				N

6. The allocation of "joint costs" presents a problem for cost-benefit evaluators. Joint costs occur when an educational input, such as a teacher, piece of equipment, or school building, is used by more than one student group. Please rate the desirability and feasibility of the following treatments of joint cost:

	Desirability				Feasibility				
Rating	4	3	2	1	4	3	2	1	
- Exclude from analysis			2	4	2	1		2	N
- Evaluate the marginal cost of use		5	1		2	2	1		N
- Evaluate the average cost of use	3	4			4	2			N
- Other (please specify) (Game Theory)	1					1			N

COMMENTS ON SECTION II -- QUESTION 5

-- By social discount rate, I mean one which includes inflation and also a term for deferred benefits. If the analysis is done in present dollars, the inflation effect might be neglected.

-- What if rates decrease and increase? What then? How about career patterns, change of jobs ?

COMMENTS ON SECTION II -- QUESTION 6

-- Allocation of joint costs is a researchable issue. None of the first three is very good. The study should generate its own model, taking into account some of the recent advances in Game Theory (e.g. Shapley Value, nucleolus).

-- Marginal costs would be most appropriate if you can identify the main use program. Average cost would probably be easier to obtain.

7. The opportunity cost of attending a vocational education program may enter in as one of the largest cost components in a cost-benefit analysis. An opportunity cost is the income a student would have earned had he/she been working rather than attending school. The appropriate estimator of income foregone may differ by program level. Please rate the desirability and feasibility of the following estimators of foregone income for the secondary, postsecondary, and adult vocational education levels.

   a. For secondary vocational education, the appropriate estimator of the opportunity cost of attendance might be:

	Desirability				Feasibility				
- Zero, the individual would be attending school anyway		3	2	1	4	2			N
- The average income of individuals of high school age who are not attending school	1	4	1	1	4	1	2		N
- A weighted average of the two previous measures	2	1	1	2	3	1	1	1	N
- Other (please specify)	1				1				N
	4	3	2	1	4	3	2	1	Rating

   b. For postsecondary vocational education, the appropriate estimator of the opportunity cost of attendance might be:

	Desirability				Feasibility				
- Zero, the student would be attending school anyway			3	3	3	1	1	1	N
- The average earnings of individuals of similar characteristics who are not attending school	3	4			4	3			N
- A weighted average of the previous two estimators			3	3	2	2	1	1	N
- Other (please specify) (Weighted average and comparison with costs of other education programs)	1				1				N
	4	3	2	1	4	3	2	1	Rating

COMMENTS ON SECTION II -- QUESTION 7 a.

-- The measure should take into account some comparison with B - C of enrollment in other secondary programs as well as income of non-attendees.

COMMENTS ON SECTION II -- QUESTION 7 b.

7. c. For adult vocational education, the appropriate estimator of the opportunity cost of attendance might be:

	Desirability				Feasibility				
- Zero, the student would be attending school anyway			2	4	2		3	1	N
- The average earnings of individuals of similar characteristics who are not attending school	4	2	1		4	2	1		N
- A weighted average of the two previous estimators			2	4	2		2	2	N
- Other (please specify)									N
	4	3	2	1	4	3	2	1	Rating

8. Please evaluate the desirability and feasibility of utilizing the following measures of future earnings:

	Desirability				Feasibility				
	4	3	2	1	4	3	2	1	Rating
- Gross income (including investments)	1	2	2	2	2	2	1	2	N
- Annual labor earnings	4	2			4	1	1		N
- Individual hourly wage rates	1	2	3		1		2	3	N
- Other (please specify)	1				1				N

COMMENTS ON SECTION II -- QUESTION 7 c.

-- Characteristics of students will vary so much, data will be meaningless.

COMMENTS ON SECTION II -- QUESTION 8

-- I assume that all of these will be discounted to present values and will take account of ages of earners.

-- Will be difficult to obtain.

-- Hourly income could be used with the assumption that an individual is employed full time and can work full time.

9. Increased earnings resulting to a vocational education graduate have an economic impact greater than the net increase in the graduates' earnings. This results because a large portion of the increased earnings will typically be spent, increasing the income of another individual. Please rate the desirability and feasibility in a national cost-benefit study of accounting for this earnings multiplier effect.

Desirability				Feasibility				
4	3	2	1	4	3	2	1	Rating
4	2			1	4	1		N

10. Please evaluate the desirability and feasibility of including non-pecuniary costs and benefits in a cost-benefit analysis.

Desirability				Feasibility				
4	3	2	1	4	3	2	1	Rating
4	2			3	2	1		N

COMMENTS ON SECTION II -- QUESTION 9

-- This is not a transparent benefit and to use this concept will require considerable study. The basic economics of exchange imply that the worker values his wage received more than his time spent and that the employer values the work done more than the wage paid.

COMMENTS ON SECTION II -- QUESTION 10

-- This is very important and involves evaluating trade-offs between dollars and quality of life. Multicriterion benefit-cost models are beginning to emerge and should be looked into.

-- This is perhaps the most difficult aspect of this study to deal with.

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11. Please evaluate the desirability and feasibility of including measures of the differences in quality of vocational programs in a national cost-benefit analysis.

Desirability				Feasibility				
4	3	2	1	4	3	2	1	Rating
5	1	1		1	1	4	1	N

12. A student may be enrolled in vocational education for both investment and consumption reasons. It is part investment because a student is investing in "human capital" with the anticipation of future increases in income. It is part consumption since a student is consuming vocational education purely for immediate personal gratification. Evaluate the desirability and feasibility of measuring consumption benefits of vocational education in a cost-benefit study.

Desirability				Feasibility				
4	3	2	1	4	3	2	1	Rating
3	3		1		3	3	1	N

COMMENTS ON SECTION II -- QUESTION 11

- The potential political reactions to such measures make this a delicate matter. It is worth consideration but including such measures may lower acceptability of the whole effect.
- Careful consideration of standard criteria for quality or effectiveness must be established.

COMMENTS ON SECTION II -- QUESTION 12

-- This area is very important, though probably very hard to collect data on. Many detractors of vocational education cite personal consumption as a waste, yet it is almost impossible to factor it out. The detractors feel the programs are too expensive to run so someone can learn how to fix their car or some other personal skill. These data could help to refute this.

-- This is closely related to 10.

III. QUESTIONS ON DATA AVAILABILITY

There are several sources of data that can be used in a national cost-benefit study of vocational education. The following questions consider some of these alternatives.

1. Please evaluate the desirability and feasibility of utilizing the following types of data in a national cost-benefit analysis of vocational education:

	Desirability				Feasibility				
- Existing data bases	2	3	1		2	3			N
- Existing data bases supplemented by survey data	5	1			2	4			N
- Survey data collected exclusively for the cost-benefit study	2	2		1	2	2		1	N
	4	3	2	1	4	3	2	1	Rating

2. Please evaluate the desirability and feasibility of using the following data bases in a national cost-benefit study:

	Desirability				Feasibility				Not Familiar With Data Base	
	4	3	2	1	4	3	2	1		Rating
- National Center for Educational Statistics' (NCES) Vocational Education Data System (VEDS)	1	1	2		1	3			1	N
- Bureau of Occupational and Adult Education's (BOAE) Statistical Reports, 1973-1978	1	2	1		1	3			1	N
- NCES' High School and Beyond Longitudinal Survey (1980)	1		1	1	1	1		1	2	N
- Department of Labor's (DOL) National Longitudinal Survey (1979)		1	1	1		1	1	1	2	N
- NCES' National Longitudinal Survey of the High School Class of 1972		1	1	1	1		1	1	2	N
- National Institute of Education's (NIE) Survey of Vocational Schools in Ten States (1980)			1	1		1		1	3	N

COMMENTS ON SECTION III -- QUESTION 1

-- The major reliance should be on existing data bases but there may be gaps which require survey data.

COMMENTS ON SECTION III -- QUESTION 2

-- You may need a cross-checking of these data bases for verifying data needed for a cost-benefit study.

-- Recommend that you conduct your own sample - could use existing data bases to draw sample - under these cirucumstances a higher rating could be made on some of the data bases listed. The VED's System would probably be best for this use on vocational students. You would need another base for more vocational students from one of those listed of which I am not knowledgeable.

2. (cont'd.)

	Desirability				Feasibility				Not Familiar With Data Base	Rating
	4	3	2	1	4	3	2	1		
- NCES' Survey of Noncollegiate Postsecondary Students and Schools (1972-1980)		1		1		1		1	4	N
- Assistant Secretary for Planning and Evaluation's (ASPE) Survey of Vocational Education Students and Teachers (1972)	1		2	1	1		1	1	1	N
- Office of Civil Rights' (OCR) Survey of Vocational Education Schools (1979)	1	1	2		1	1	2		1	N
- Office of Education's (OE) "437 Files" (Grants and Expenditures under State Administered Programs)			1	1		1		1	3	N
- Census Bureau's Current Population Survey Supplement	1	2		1	1	2		1	2	N
- Project Talent Data Base	1			1	1			1	4	N
- NCES' Survey of Course Offerings and Enrollments (1973)				1				1	5	N
- Survey Research Center's Youth in Transition Data Base (1966)				1				1	5	N

ROUND TWO

I. QUESTIONS ON GENERAL STUDY DESIGN

The following questions deal with general issues in the design of a national cost-benefit study of vocational education.

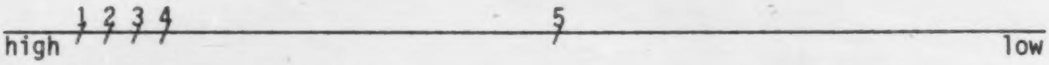
1. A national cost-benefit study of vocational education must be designed to meet the needs of its users. Please rank,in order of preference, the desirability of designing a study which would yield information to meet the needs of the following user groups:

	Mean *
-- Individuals, whose needs might include determining whether vocational training will result in increased income, career advancement, or other benefits	3.8
-- Educational institutions, whose needs might include increasing the efficiency of vocational programs	3.7
-- Local education agencies, whose needs might include securing efficient investments in vocational programs	3.2
-- State education agencies, whose needs might include determining how to distribute educational revenues to maximize educational output	2.0
-- Federal Government, whose needs might include allocating federal funds to the most efficient alternative programs	2.3
-- Other (please specify)	

*Mean indicates the mean value assigned to this option by panelists.

COMMENTS ON SECTION I -- QUESTION 1

-- Dissemination of relevant information to individuals is important, but I feel that for them there are better approaches than benefit-cost models, except perhaps at the nominal level. The other four groups have comparable needs and the shadings between the ratings 1-4 are small compared with the differences with individual needs (5). i.e.



-- The federal government's needs would entail the use of cost-benefit data in judging the return on investment. It may be necessary or desirable to fund programs which have both high costs and high benefits. Funding decisions might not always favor the most efficient alternative programs.

-- Focusing upon meeting needs of local education agencies, a cost-benefit study shall be made, then the study can be expanded toward meeting other agencies' needs.

-- I would target on my first (state education agencies) and second (Federal Government) rankings.

-- The RFP should have made clear that the main purpose of any resulting national cost/benefit study was to serve federal policy determination needs.

-- The usefulness of any program ratios at less than national policy levels is debatable, given the likelihood that these ratios will vary considerably across states, communities, and institutions.

-- The effectiveness and ultimate impact of study measures/findings will be determined according to its utility for those most directly involved in the provision and consumption of vocational services. Thus educational institutions, individuals and LGA's are the user groups of primary import in the development of any national cost-benefit study.

-- Given the recent White House economic victory in Congress, an emphasis on the needs of state education agencies would appear to be the most appropriate.

-- The ranking is based upon (1) the individuals needs being met. The remaining ranking is based upon the funding sources and their understanding of true need

2. Please rank, in order of preference, the desirability of each of the following possibilities in designing a national cost-benefit study of vocational education:

	Mean
-- Narrow the focus of the study to a single user and construct a compact model	2.8
-- Develop a broad and versatile model that would provide results that are meaningful to many or all potential users and on diverse programs	1.8
-- Construct several models that separately address the information needs of different users and the characteristics of different programs	1.4

3. Please rank, in order of preference, the desirability of each of the following considerations in designing a national cost-benefit study of vocational education:

	Mean
-- Study design should be dictated by the current availability of data	2.1
-- Study design should be dictated by model construct capabilities	1.4
-- Study design should be dictated by cost considerations	2.4

COMMENTS ON SECTION I -- QUESTION 2

-- A good broad model can be specialized to achieve the goals of the other two statements. However, if a single user is paying for the model, he has a right to expect it to be focused on his needs.

-- The most useful and productive approach may be option 3 with some degree of data compatability to assure that outputs can be aggretated across models for different users, e.g. community colleges, AVC's, etc.

-- I do not think it is possible to design a single model which will serve all potential users within realistic cost constraints.

While the basic procedures for determining cost and benefit might be the same (or similar) regardless of level of aggregation (national, state, or local), the procedures for program selection (universe or sample) and the approach to data acquisition would vary considerably.

The model should be practical rather than theoretical. An elegant model which cannot be applied is of no use, in my opinion.

-- The development of several discrete models will provide the necessary breadth and depth in addressing the critical areas of assessment - i.e. the dimensions related to multiple educational levels and varied user groups. Strategies for the analysis of common program elements (which would be available through the broad and versatile model design) should be incorporated into the multiple model study design.

-- Only by developing a number of models is it possible to take into consideration the myriad of diverse needs of the many potential users. "A broad and versatile model" would provide severely limited information.

-- A broad model would allow many individuals and agencies to use the information.

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COMMENTS ON SECTION I -- QUESTION 3

-- If the design requires expenditures beyond the project budget, it has no chance to have a good outcome. However, once budget feasibility is established, the model should not be strictly limited by currently available data since one major benefit of a b-c model is identification of data needs.

-- Since a national cost-benefit study has yet to be developed for/by vocational education, it is not likely that the currently available data will be adequate or appropriate.

-- Given that 1) current data availability and potential resources for the study pose severe programmatic constraints, and 2) the quality of study activities and findings are dependent upon a solid, comprehensive model design, the consideration of model construct capabilities are paramount. Of course the delimiting factors cited in point 1 (above) will necessitate flexibility in the development of the model.

4. The scope of a national cost-benefit evaluation is of particular concern. The larger the scope, the more generalizable are the results. However, the larger the scope, the less specific are the results concerning educational level and program area. Please rank, in order of preference, the desirability of conducting a national cost-benefit study of the following educational levels:

	Mean
-- An examination of secondary vocational education programs only	2.6
-- An examination of postsecondary vocational education programs only	3.1
-- An examination of adult vocational education programs only	4.0
-- An aggregated examination of secondary, postsecondary, and adult vocational education programs	3.9
-- An examination of secondary, postsecondary, and adult vocational education programs with each level analyzed separately	1.0

COMMENTS ON SECTION I -- QUESTION 4

-- Since vocational education is a relatively large and diverse national enterprise, it would be most helpful to examine all levels independently. If one had to choose between the three levels, however, the preference should go to the secondary level because it represents the largest enrollment and resource consumption.

-- The types of benefits differ considerably by institutional level. For example, while job placement rates and earning levels might be the most appropriate benefit measures for postsecondary and adult programs, the benefit of secondary programs might be most appropriately judged by levels of skill proficiency or attitudinal changes. Consequently, I do not see how an aggregate benefit assessment across institutional levels could be fairly constructed.

The postsecondary and adult option (combined) was selected second because I feel traditional cost/benefit analyses are most easily applied at these levels than at the secondary level.

-- Separate analysis of vocational education programs will allow for the specificity required for a valuable cost-benefit study. However, a cross study analysis of several relative cost-benefit measures across several management and program content variables is encouraged.

-- A national cost-benefit evaluation restricted to a particular program level or aggregated over all levels would be of little use.

-- The #1 ranking would allow for the generation of both general and specific data.

II. QUESTIONS ON MEASUREMENT ISSUES

Numerous measurement problems will confront a study team performing a national cost-benefit analysis of vocational education. The following questions present some of the concepts that may result in measurement problems.

1. One of the first problems encountered when considering a cost-benefit analysis is to determine who is a vocational education student. Please rank, in order of preference, the desirability of using the following criteria for determining a vocational education program participant:

	Mean
-- Enrollment in at least one vocational class	2.9
-- Enrollment in more than one vocational class	2.4
-- Enrollment in a fixed series of related vocational classes	1.8
-- A combination of the above three measures	3.0
-- Other (please specify)	

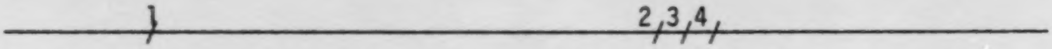
2. Once an appropriate determination has been made on what determines a vocational education program participant, a suitable method for counting these students needs to be determined. Please rank, in order of preference, the desirability of using the following measures of student participation:

	Mean
-- Average Daily Attendance (ADA)	2.8
-- Average Daily Membership (ADM)	3.3
-- (ADA + ADM)/2	3.3
-- Full-time Equivalent (FTE)	1.5
-- Other (please specify)	

COMMENTS ON SECTION II -- QUESTION 1

-- At the post-secondary and adult levels clearly the interest lies with students training for a specific occupation. However, at the secondary level where the purposes and benefits of vocational education participation can be more broadly construed, attention should also be paid to students in exploratory vocational education programs. That is to say care must be taken at the secondary level in distinguishing between those students in occupational specific programs and those students in exploratory or prevocational programs. Different benefit measures should be applied. In any case, the benefits should not be averaged.

-- If one distinguishes grades of vocational education students as provided in II-2 below, then I would change the ratings to 1, 3, 4, 2, with



-- Nearly all states have established vocational program course sequences through which students accumulate skills over a period of 1-2 years.

-- You have to define the level of programs - class level, course level, or program level. Personally, I would like to suggest the level of program for a national study.

-- I would very much have liked to have seen a question related to a program rather than a class. If this was available under other, I would have rated it #1.

-- FTE provides for the most accurate measurement of student participation time in a vocational program.

COMMENTS ON SECTION II -- QUESTION 2

-- Clearly student contact hours in the program is the preferable approach to measuring program participation. However, an ADA or ADM count combined with a sorted enrollment count (II above) would be satisfactory.

-- FTE is an excellent measure of load on the system (I assume this is based on some equivalence with credit hours of enrollments.) However, seriousness of participants is measured by average daily attendance. I suggest for a class the measure:

(No. of hours per week) X (No. of enrollees) X R

where R is a reduction factor to account for absentees. R should probably not be linear.

-- Use one criteria to be universally adaptable!

-- Other Some other indicator measuring participation except attendance or membership. ADA and ADM are completely unsatisfactory to me as an indicator of a participant.

-- Since instructional service outputs are for students, the more appropriate unit for study would seem to be a measure of student service unit. The more precise and widely applicable cost unit appears to be the concept of the FTE student, based on a standard number of student contact hours.

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3. The costs and benefits resulting from vocational education need to be compared to those of one or more alternative activities. Those comparison activities may differ by educational level.

a. Please rank, in order of preference, the desirability of comparing the costs and benefits of secondary vocational education with the costs and benefits of:

	Mean
-- Attending a general education program	1.8
-- Attending a college preparatory program	2.3
-- Not attending secondary school	2.8
-- A weighted average of the three previously mentioned activities	2.7
-- Other (please specify)	

b. Please rank, in order of preference, the desirability of comparing the costs and benefits of postsecondary vocational education with the costs and benefits of:

	Mean
-- Attending a two-year general curriculum college	2.0
-- Attending a four-year general curriculum college	3.1
-- Not attending a postsecondary school	2.1
-- A weighted average of the three previously mentioned activities	2.7
-- Other (please specify)	

COMMENTS ON SECTION II -- QUESTION 3 a.

-- It is not clear to me why a comparison of the vocational educational cost/benefit ratios to those of the ratios discovered for other programs is necessary or particularly valid-particularly in terms of the college preparatory program. I suppose if one discovered that general education students (with careful matching of ability and SES background) did about as well as Vo Ed students in terms of employment and wages at substantially lower programs costs one might use the information for allocation decisions. However, I'm not at all comfortable with where such ratios comparisons might lead policy makers. Present cost/benefit ratio studies assign much higher values to elementary and junior high education than to the higher grades. Similarly lower education scores higher than higher education. What are we to make of this in terms of public policy?

-- Parents and students alike will find information on the costs and benefits of vocational education most helpful when trying to judge its value relative to college prep programs.

-- How would you give a different weight to three areas?

-- Other - other non-public voc. programs, CETA programs. I do not believe the study should compare academic and voc. ed.

COMMENTS ON SECTION II -- QUESTION 3 b.

-- One might want to compare the relative effectiveness and efficiency of vocational education training at the post-secondary and secondary levels. Although this would be a difficult task to do fairly.

The most appropriate comparison would be between two populations with similar occupational goals - one of which participated in post-secondary Vo Ed and the other which did not.

-- Here again, such information will be extremely useful in career planning for potential post-secondary students.

4. The costs and benefits of vocational education accrue to various individuals and groups. An essential consideration for any cost-benefit calculation is to determine for which entity (i.e. an individual or society as a whole) costs and benefits should be evaluated in a national study. Please rank, in order of preference, the desirability of evaluating the cost and benefits accruing to the following:

	Mean
-- The vocational education enrollee	1.6
-- Society as a whole (including the enrollee)	1.6
-- Society exclusive of the vocational enrollee	3.0
-- Other (please specify)	

5. The allocation of "joint costs" presents a problem for cost-benefit evaluators. Joint costs occur when an educational input, such as a teacher, piece of equipment, or school building, is used by more than one student group. Please rank, in order of preference, the desirability of the following treatments of joint cost:

	Mean
-- Exclude from analysis	3.4
-- Evaluate the marginal cost of use	2.1
-- Evaluate the average cost of use	1.6
-- Evaluate using game theory	3.3
-- Other (please specify)	

COMMENTS ON SECTION II -- QUESTION 4

-- The primary concern of the study should be with individual benefits by program.

-- This rates the "who benefits" "who pays" question.

[1] [2] [3]

Both society as a whole and the individual enrollee must have net positive gain (benefit-cost) for the program to be workable.

-- Difficulties exist with measurement of the non-economic costs and benefits associated with vocational education, e.g. increased levels of employee/worker satisfaction.

-- Other: Special populations, including rural, urban, bilingual, and handicapped populations.

COMMENTS ON SECTION II -- QUESTION 5

-- In measuring costs, the model should attempt to strive for reasonable precision where such precision is likely to make a significant difference in cost calculations. For instance a classroom in which distributive education is taught will vary little in construction costs from a regular classroom (averages would be appropriate). On the other hand the costs of constructing a heavy machine shop should not be averaged with total building costs.

I don't understand the point of the question when it speaks to teachers. I see no problem with using average teacher salaries given a single salary schedule (if that is what is meant). If a teacher splits his time between Vo Ed and the general curriculum, then his salary should be prorated according to program assignment.

-- Other: judicious use of all three methods. For starting a new added program, marginal costs may be the best; for evaluating a whole system, average cost is attractive; game theory methods are relevant when considering several different added programs or combinations thereof.

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COMMENTS ON SECTION III -- QUESTIONS 1, 2, 3

(The following questions are designed to allow panelists input in suggesting issues and questions that they feel are important in designing a national cost-benefit study of vocational education.)

1. Please list what you consider to be the two major obstacles to performing a national cost-benefit analysis of vocational education:

Obstacle I The most important obstacle is defining and identifying the control groups from which the marginal benefits of vocational education training can be derived.

Obstacle II Constructing operational measures of the benefits of the non-occupational specific secondary vocational education programs and translating these into monetary values.

Obstacle III Obtaining valid employment and wage histories of students.

Comments:

2. Briefly describe a strategy for overcoming, minimizing, or dealing with each obstacle listed in response to the previous question.

Obstacle I

Obstacle II

Comments:

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1. Please list what you consider to be the two major obstacles to performing a national cost-benefit analysis of vocational education:

Obstacle I Lack of good measures for non-monetary costs and benefits.

Obstacle II Critical gaps in the data base.

Comments: Observations of the national, state, and other decision-making leads to the conclusion that political and quality of life factors play crucial roles. Hence, models which neglect these or dismiss them with the disclaimer that "since they con't be measured, we will omit them from our model" are seriously deficient.

One feature of model building is that a good theoretical model helps pinpoint what the crucial data needs are. It usually is the case that some of the needed data has never been collected, tabulated or stored (in accessible form).

2. Briefly describe a strategy for overcoming, minimizing, or dealing with each obstacle listed in response to the previous question.

Obstacle I The Rice-TIRR group has focused on handling non-monetary costs and benefits in rehabilitation. Some of their results seem applicable here. (Most of their reports are in the REHAB files.)

Obstacle II Several approaches are: a) set up an MIS (Management Information System) to process and handle such data as are available; b) encourage adding important items to statutory reporting systems; c) find acceptable surrogates which are available.

Comments:

1. Please list what you consider to be the two major obstacles to performing a national cost-benefit analysis of vocational education:

Obstacle I Developing a model or series of models which will meet the expectations and needs of the diverse and numerous user groups.

Obstacle II Suggesting ways to measure the non-economic costs and benefits of vocational education.

Comments:

2. Briefly describe a strategy for overcoming, minimizing, or dealing with each obstacle listed in response to the previous question.

Obstacle I Once a model or series of models is developed, a series of rigorous field tests with each of the major user groups from a representative sample of states should be conducted. The further development and evaluation of the models involve a sizable group of vocational education leaders over an extended period of time (2-3 years) to assure.

Obstacle II Continue to review the literature and discuss this issue with knowledgeable individuals.

Comments:

1. Please list what you consider to be the two major obstacles to performing a national cost-benefit analysis of vocational education:

Obstacle I The quality of data - need a unified data system including common definitions of data items and systematic data collection.

Obstacle II Finding group comparable with others.

Obstacle III Sensitivity of information opening to the "public".

Obstacle IV Need a cooperative participation of selected agencies and individuals.

Comments:

2. Briefly describe a strategy for overcoming, minimizing, or dealing with each obstacle listed in response to the previous question.

Obstacle I May need a longitudinal approach to data definition and collection.

Obstacle II A unified data system

Obstacle III and IV A cooperative participation of selected agencies.

Comments:

1. Please list what you consider to be the two major obstacles to performing a national cost-benefit analysis of vocational education:

Obstacle I Determining the specific cost per program and then aggregating to represent a cost of Vocational Education. Both Direct and Indirect costs.

Obstacle II Getting an agreement on what benefit to measure and then measuring the benefit or benefits.

Comments: There exists little information today in regard to cost per program. One can get from existing reports expenditures from local, state, and federal levels, but this is probably not a good indication of actual cost because so many variables are related that may not be directly related to training. A few years ago we developed standardized cost per program and I can tell you it is a lengthy exercise. When you start prorating over secondary, postsecondary, and adult it is even more complicated.

I assure you that an agreement cannot be reached on benefits. In the study that was conducted here in Oklahoma we attempted this. We ended up with six objective functions: (continued on next page)

2. Briefly describe a strategy for overcoming, minimizing, or dealing with each obstacle listed in response to the previous question.

Obstacle I Narrow down exactly what kind of cost you are going to use and represent your study as a study that has been conducted under this specific set of assumptions.

Obstacle II The same as the above comment. Acceptance of benefits are extremely difficult to get. You may want to measure benefits under different alternatives.

Comments: A constraint that you need to be aware of is the fact that you do not have an unlimited supply of individuals that can enter any level of employment that they choose. You really have a supply of persons that have varying attitudes and abilities and the benefits derived from vocational training may be a great return to cost if this was considered.

Based on previous research done in this unit we had access to 40,000 sophomores, 10,000 seniors, and 10,000 adults' GATB scores to use as an indicator with supply. When trying to fill jobs we found that certain occupations competed for the same GATB scores and that our supply of individuals were not available to satisfy all the job vacancies.

1. Comments (continued):

1. maximize entry level wages;
2. maximize supply;
3. maximize returns to taxes;
4. maximize to fill demand for trained workers;
5. maximize number of students served;
6. minimize costs.

If you cannot get agreement on benefits to be measured then no one will accept your study. Therefore, I assure you that you have a challenge.

1. Please list what you consider to be the two major obstacles to performing a national cost-benefit analysis of vocational education:

   Obstacle I Lack of common definitions of what a Voc. Ed. program is in the various states.

   Obstacle II Lack of complete fiscal information at many levels.

   Comments:

2. Briefly describe a strategy for overcoming, minimizing, or dealing with each obstacle listed in response to the previous question.

   Obstacle I Set a standard for the study only.

   Obstacle II Collect the data.

   Comments:

1. Please list what you consider to be the two major obstacles to performing a national cost-benefit analysis of vocational education:

Obstacle I The inclusion of non-pecuniary costs and benefits in the study.

Obstacle II The consideration of the impact of vocational programming upon special populations (i.e. rural, urban, bilingual, and handicapped).

Comments: This is probably the most difficult measurement area upon which to gain consensus. However, it is an area in which vocational education stands to promote its most compelling justification for existence - social (as well as economic) benefits.

This consideration is particularly critical to federal and state administrations as a result of set aside requirements for special populations.

2. Briefly describe a strategy for overcoming, minimizing, or dealing with each obstacle listed in response to the previous question.

Obstacle I If the study team selects the method of measuring non-pecuniary benefits according the monetary values, an additional Delphi procedure will be required to determine the variables to be selected and the weighting of such variables.

Obstacle II The study team may wish to devise strategies for the collection of special population data from 1) segregated vocational programs, and 2) integrated, regular vocational programs which include representatives from identified special populations. Data collected for these populations should be equivalent to the data collected for the general study populations.

Comments:

1. Please list what you consider to be the two major obstacles to performing a national cost-benefit analysis of vocational education:

Obstacle I Securing clear accurate data that is transferable throughout the U.S.

Obstacle II Money and time. A study of this nature should have the time and resources to develop a research model or models that will be researchable and yield the data needed to be a comprehensive cost-benefit study.

Comments:

2. Briefly describe a strategy for overcoming, minimizing, or dealing with each obstacle listed in response to the previous question.

Obstacle I Develop several methods of gathering data based upon the uniqueness of states.

Obstacle II With the current mood in Washington, about the only hope is time to do the job. Money will not be forthcoming.

Comments:

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3. Please write two questions that you feel must be addressed by a research team in designing a national cost-benefit analysis of vocational education.

These questions can deal with measurement problems, study methodology, user groups, data availability, or any other issue of your choice as long as it has not been asked previously in this questionnaire. You do not have to answer the questions.

Question I -- How can appropriate managers be encouraged to use benefit-cost methodology and results?

Question II -- Where does one draw the line between inputs by the model builder and inputs from the responsible manager?
My thesis is that value judgements should be provided by the manager at as near as possible to the time he needs to make a decision.

Comments: One clue to this question is documentation. I mention two important levels:

A. Technical documentation
B. User documentation

A criterion for satisfactory technical documentation is transferability, i.e. a knowledgeable user should be able to understand (a) the definitions of all of the variables, (b) the data sources needed, (c) the underlying assumptions and (d) the logic supporting the equations well enough to apply the model without recourse to the model builder.

Relatively few models paid for by the U.S. Government meet this criterion. However, the Dept. of Energy now requires archival storage (at its Argonne Laboratories) in transferable form.

User documentation is even rarer than good technical documentation. What I have in mind here includes verbal formulation of all equations, assumptions, etc. so that a manager can understand the thrust of the model even though he is not a specialist (i.e. knowledgeable) in model building.

(If this question is followed up, I can provide a number of references.)

3. Please write two questions that you feel must be addressed by a research team in designing a national cost-benefit analysis of vocational education.

These questions can deal with measurement problems, study methodology, user groups, data availability, or any other issue of your choice as long as it has not been asked previously in this questionnaire. You do not have to answer the questions.

Question I -- What data are currently collected by states or are available from national sources (e.g. NCES) that could be analyzed and used as gross indicators of the costs and benefits of vocational education for various special needs populations?

Question II -- Why should vocational educators at all levels be concerned with cost-benefit analysis?

Comments:

3. Please write two questions that you feel must be addressed by a research team in designing a national cost-benefit analysis of vocational education.

These questions can deal with measurement problems, study methodology, user groups, data availability, or any other issue of your choice as long as it has not been asked previously in this questionnaire. You do not have to answer the questions.

Question I -- Attempt to analyze preliminary data available to each of the selected local agencies.

Question II --

Comments:

3. Please write two questions that you feel must be addressed by a research team in designing a national cost-benefit analysis of vocational education.

These questions can deal with measurement problems, study methodology, user groups, data availability, or any other issue of your choice as long as it has not been asked previously in this questionnaire. You do not have to answer the questions.

Question I -- Are you planning to use aggregate data or individual program data?

Question II -- How are you planning to get information to study cost-benefit if aggregate data are not used?

Comments:

3. Please write two questions that you feel must be addressed by a research team in designing a national cost-benefit analysis of vocational education.

These questions can deal with measurement problems, study methodology, user groups, data availability, or any other issue of your choice as long as it has not been asked previously in this questionnaire. You do not have to answer the questions.

Question I -- What are the non-pecuniary benefits derived from vocational education (i.e. secondary, post-secondary, and adult programming)?

Question II -- What have been the economic and non-pecuniary benefits of vocational programming (i.e. secondary, post-secondary, and adult) on special populations (i.e. rural, urban, bilingual, and handicapped)?

Comments:

3. Please write two questions that you feel must be addressed by a research team in designing a national cost-benefit analysis of vocational education.

These questions can deal with measurement problems, study methodology, user groups, data availability, or any other issue of your choice as long as it has not been asked previously in this questionnaire. You do not have to answer the question.

Question I How are special needs students being accomodated in vocational education and how does the cost of their involvement affect the program within which they are enrolled?

Question II What is the payback period (taxes and non receipt of welfare) for graduates of vocational programs as opposed to non-vocational graduates?

Comments:

APPENDIX G
LIST OF PARTICIPANTS AT THIRD ROUND DELPHI CONFERENCE

CONFERENCE ON THE FEASIBILITY OF CONDUCTING A NATIONAL COST-BENEFIT ANALYSIS OF VOCATIONAL EDUCATION

August 10, 1981 9 A.M. - 5 P.M.

LIST OF PARTICIPANTS

Dr. Ralph Bregman
National Advisory Council for Vocational Education

Ms. Barbara Dunn
Youthwork, Inc.

Dr. George Hagerty
U.S. Department of Education
Division of Personnel Preparation

Dr. Paul Hippolitus
President's Commission on Employment of the Handicapped

Dr. Krishan Paul
American Vocational Association

Dr. L. Allen Phelps
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REHAB GROUP, INC. STUDY TEAM

Dr. Diane Simison - Project Director

Dr. Mark Shugoll - Principal Investigator

Mr. Tim Helms

Ms. Dorine Seidman

Dr. David Rodney

APPENDIX H

AGENDA FOR THIRD ROUND DELPHI CONFERENCE

CONFERENCE ON THE FEASIBILITY OF CONDUCTING A NATIONAL COST-BENEFIT ANALYSIS OF VOCATIONAL EDUCATION

August 10, 1981 9 A.M. - 5 P.M.

AGENDA

9:00---------------Continental Breakfast

9:20---------------Introductions

9:30---------------Overview of the Rehab Group, Inc. study effort

9:45 - 10:45-------Discussion: Evaluating the merits and parameters of a
national study

10:45 - 11:00------Break

11:00 - 12:00------Discussion: Identification and measurement of vocational
benefits

12:00 - 1:30-------Lunch

1:30 - 2:30--------Discussion: The availability and quality of data on
vocational programs and vocational students

2:30 - 3:30--------Discussion: Issues identified by conference participants

3:30 - 3:45--------Break

3:45 - 4:45--------Discussion: Conclusions on the overall feasibility and
utility of a national cost-benefit study

4:45 - 5:00--------Closing remarks